Kansas City
Public Library

THE SCHOOL DISTRICT OF KANSAS CITY, MISSOURI

This Volume is for

REFERENCE USE ONLY

KANSAS CITY
MO

From the collection of the

Prelinger Library

San Francisco, California
2008

KANSAS CITY
MO

PUBLIC LIBRARY
KANSAS CITY
MO

Index to the

Bell Telephone Magazine

Volume XXVI, 1947

Information Department
AMERICAN TELEPHONE AND TELEGRAPH COMPANY
New York 7, N. Y.

PUBLIC LIBRARY
KANSAS CITY
MO

PRINTED IN U. S. A.

BELL TELEPHONE MAGAZINE

VOLUME XXVI, 1947

TABLE OF CONTENTS

SPRING, 1947

The Teacher, by *A. M. Sullivan* 3
A Tribute to Alexander Graham Bell, by *Walter S. Gifford* 4
Mr. Bell and Bell Laboratories, by *Oliver E. Buckley* 6
Two Men and a Piece of Wire—*and Faith* 12
The Pioneers and the First Pioneer 21
The Bell Centennial in the Press 25
Helen Keller and Dr. Bell 29
The First Twenty-Five Years, by *The Editors* 30
America Is Calling, by *William G. Thompson* 35
Preparing Histories of the Telephone Business, by *Samuel T. Cushing* 52
Preparing a History of the Telephone in Connecticut, by *Edward M. Foley, Jr.* 56
Who's Who & What's What 67

SUMMER, 1947

The Responsibility of Management in the Bell System, by *Walter S. Gifford* 70
Helping Customers Improve Telephone Usage Habits, by *Justin E. Hoy* 72
Employees Enjoy more than 70 Out-of-hour Activities, by *John G. Simmons* 81
Keeping Our Automotive Equipment Modern, by *Temple C. Smith* 90
Mark Twain and the Telephone 100
Crossed Wireless 104
Twenty-five Years Ago in the Bell Telephone Quarterly 105
Who's Who & What's What 107

AUTUMN, 1947

Distribution by Western Electric Company, by *Alvin von Auw* ... 113
How Big Are the Little Things in the Telephone Business?, by *Keith S. McHugh* ... 124
Plastics—Their Growing Use in Telephone Plant, by *John R. Townsend* ... 127
Excursion in Engineering, by *Carroll O. Bickelhaupt* ... 136
Telephones in the World of 1947, by *James R. McGowan* ... 139
"The New Bell Telephone" ... 149
Hammond V. Hayes: 1860–1947, by *Roger B. Hill and Thomas Shaw* ... 150
Twenty-five Years Ago in the Bell Telephone Quarterly ... 174

WINTER, 1947-1948

Operator Toll Dialing—the Coming Way, by *Ralph I. Mabbs* ... 181
Keeping Our Sights High, by *Keith S. McHugh* ... 191
The International Telecommunication Conference of 1947, by *Bartlett T. Miller* ... 192
Opening of New York-Boston Radio Relay System Is Historic Event ... 204
"Arms of the Law"—Police Communications, by *Richard B. Holt*. 208
Forest Fire: What an Unchecked Holocaust Wrought in Maine, by *Timothy P. Mannix* ... 221
Weather Charts by Wire for the Air Force, by *Harry Jeavons* ... 228
Twenty-five Years Ago in the Bell Telephone Quarterly ... 240
The Biggest Offer Ever, by *Frederick A. Wiseman* ... 242

BELL TELEPHONE MAGAZINE

VOLUME XXVI, 1947

INDEX

A

	Issue	Page
"America Is Calling" by William G. Thompson—9 photos, 3 maps, 2 charts	Sp	35
American Telephone and Telegraph Company:		
"The Biggest Offer Ever" by Frederick A. Wiseman—8 photos	Wi	242
"Hammond V. Hayes: 1860–1947" by Roger B. Hill and Thomas Shaw, with an introductory note by W. H. Harrison—10 photos, 3 charts	Au	150
"American Telephone and Telegraph Company Headquarters"	Wi	240
American Telephone Historical Library: "Preparing Histories of the Telephone Business" by Samuel T. Cushing	Sp	52
Annual Reports: A. T. & T.—1905. Comment on rate reductions	Au	170
"'Arms of the Law'—Police Communications" by Richard B. Holt—8 photos, 1 map	Wi	208
Automotive Authority	Au	135
Automotive Equipment: "Keeping Our Automotive Equipment Modern" by Temple C. Smith—14 photos	Su	90

B

Barrett, J. A.:		
Demonstrated advantages of paper as cable insulation, 1888	Au	157
Invented ABC system of transpositions	Au	162
Bell, Alexander Graham:		
"The Bell Centennial in the Press"—2 photos	Sp	25
"Mr. Bell and the Bell Laboratories" by Oliver E. Buckley—4 photos, 1 map	Sp	6
"Crossed Wireless"	Su	104
"Death of Dr. Bell"	Au	174
"Dr. Bell's Telephone Service"	Au	174
"From Edinburgh"	Sp	66
"Helen Keller and Dr. Bell"	Sp	29
Letter from President Truman to Mrs. Grosvenor on Bell Centennial—1 photo	Sp	2
"The Pioneers and the First Pioneer"—3 photos	Sp	21
Round the States Telephone Circuit for Bell Centennial—1 map, 1 photo	Sp	10
"The Teacher" by A. M. Sullivan—Poem	Sp	3

	Issue	Page
"A Tribute Paid to Alexander Graham Bell During the Bell Centennial" by Walter S. Gifford—2 portraits	Sp	4
"Two Men and a Piece of Wire—*and Faith*"—7 photos	Sp	12
Bell, Mrs. Alexander Graham:		
Letter to J. J. Carty on A. G. Bell's use of telephone service	Au	174
"Bell Centenntial in the Press, The"—2 photos	Sp	25
Bell Telephone Laboratories:		
"Hammond V. Hayes: 1860–1947" by Roger B. Hill and Thomas Shaw, with an introductory note by W. H. Harrison—10 photos, 3 charts	Au	150
"Mr. Bell and the Bell Laboratories" by Oliver E. Buckley —4 photos, 1 map	Sp	6
"Plastics—Their Growing Use in Telephone Plant" by John R. Townsend—6 photos	Au	127
Bell Telephone Magazine:		
"The First Twenty-Five Years"—4 photos	Sp	30
Bickelhaupt, Carroll O.:		
Biographical sketch—portrait	Au	111, 176
"Excursion in Engineering" by Carroll O. Bickelhaupt	Au	136
"The Biggest Offer Ever" by Frederick A. Wiseman—8 photos	Wi	242
Biography:		
Bickelhaupt, Carroll O.—portrait	Au	111, 176
Buckley, Oliver E.	Sp	67
Cushing, Samuel T.—portrait	Sp	68
Foley, Edward M., Jr.—portrait	Sp	68
Gifford, Walter S.	Sp	67
Hill, Roger B.—portrait	Au	111, 176
Holt, Richard B.—portrait	Wi	179
Hoy, Justin E.—portrait	Su	107
Jeavons, Harry—portrait	Wi	179
Mabbs, Ralph I.—portrait	Wi	178
Mannix, Timothy P.—portrait	Wi	179
McGowan, James R.—portrait	Au	176
McHugh, Keith S.—portrait	Au	110
McHugh, Keith S.—portrait	Wi	178
Miller, Bartlett T.—portrait	Wi	178
Shaw, Thomas—portrait	Au	111, 176
Simmons, John G.—portrait	Su	108
Smith, Temple C.—portrait	Su	108
Thompson, William G.—portrait	Sp	68
Townsend, John R.—portrait	Au	110
von Auw, Alvin—portrait	Au	110
Wiseman, Frederick A.—portrait	Wi	179
Blackwell, O. B.: Early telephone research	Au	173
Blair, Joan: Posing with model of first telephone—photo	Sp	28
Blauvelt, W. G.: Early telephone research	Au	167
Blood, G. T.: Early telephone research	Au	173
Blue Bell: "How Angus Hibbard Designed the Blue Bell"	Su	106

	Issue	Page
Bonds—Debenture: "The Biggest Offer Ever" by Frederick A. Wiseman—8 photos	Wi	242
Buildings: "A. T. & T. Co. Headquarters"	Wi	240
Bullard, A. M.: Early telephone research	Au	167
Buckley, Oliver E.:		
Biographical sketch	Sp	67
"Mr. Bell and the Bell Laboratories"—4 photos, 1 map	Sp	6

C

Cable Plows: "Keeping Our Automotive Equipment Modern" by Temple C. Smith—2 photos	Su	90
Cables: "Hammond V. Hayes: 1860–1947" by Roger B. Hill and Thomas Shaw, with an introductory note by W. H. Harrison—10 photos, 3 charts	Au	150
Campbell, G. A.: Research in A. T. & T. Engineering Dept.	Au	162, 166
Carty, J. J.: Early telephone research	Au	173
Helped invent common-battery system	Au	160
Letter from Mrs. A. G. Bell on Dr. Bell's use of telephone	Au	174
Charlesworth, H. P.: Early telephone service	Au	173
Central Offices: "Nation-wide Operator Toll Dialing—the Coming Way" by Ralph I. Mabbs—4 photos, 1 map	Wi	181
Charts:		
Distribution of the world's telephones, January 1, 1947	Au	141
Engineering Department, A. T. & T., January, 1905	Au	172
Headquarters technical staff, American Bell Telephone Company, Dec. 31, 1885	Au	154
Headquarters technical staff, American Bell Telephone Company, Dec. 31, 1895	Au	168
Number connecting and not connecting with Bell System, 1900–1947	Au	140
Organization of International Telecommunications Union as provided in Atlantic City Convention, 1947	Wi	193
Overseas radiotelephone messages, 1927–1946	Sp	48
Overseas radiotelephone service from the United States	Sp	36
Overseas telephone service three minute week day message rate, 1927–1946	Sp	49
Ownership of the world's telephones, January 1, 1947	Au	140
Speed of telephone answer by kind of business	Su	79
Telephone conversations and telegrams, Year 1946	Au	145
Telephone development of large cities, January 1, 1947	Au	146
Telephone development of the world, by countries, January 1, 1947	Au	142
Telephones per 100 population, January 1, 1947	Au	144
The World's telephones by continental areas, January 1, 1947	Au	141
Weather Charts by Wire for the Air Force	Wi	230, 237
Chesterman, F. J.: Early telephone research	Au	173
Coaxial Cables: "Opening of New York–Boston Radio Relay System Is Historic Event"—1 map, 2 photos	Wi	204

	Issue	Page
Colpitts, E. H.: Research in A. T. & T. Engineering Dept.	Au	162
Early telephone research	Au	173
Commercial Department: "Helping Customers Improve Telephone Usage Habits" by Justin E. Hoy—7 photos, 1 chart	Su	72
Conferences—Telecommunication:		
Excerpt from speech by Walter S. Gifford, July 12, 1947	Wi	252
"The International Telecommunication Conference of 1947" by Bartlett T. Miller—7 photos, 1 chart	Wi	192
Coy, George Willard: Invented first commercial telephone switchboard—portrait	Sp	57, 58
Craft, E. B.: Early telephone research	Au	167
"Crossed Wireless"	Su	104
Cushing, Samuel T.:		
Biographical sketch—portrait	Sp	68
"Preparing Histories of the Telephone Business" by Samuel T. Cushing	Sp	52

D

Daly, John: Group portrait	Au	163
Darling, H. E.: Early telephone research	Au	173
Davis, Joseph P.: Chief Engineer, American Bell Telephone Co., 1894–1905	Au	155
"Death of Dr. Bell"	Au	174
Debentures see **Bonds—Debenture**		
Dial Systems:		
"Machine Switching in New York City"	Wi	240
"Nation-wide Operator Toll Dialing—the Coming Way" by Ralph I. Mabbs—4 photos, 1 map	Wi	181
Directories:		
"Preparing a History of the Telephone in Connecticut" by Edward M. Foley, Jr.—8 photos	Sp	56
"Mark Twain and the Telephone"—photo	Su	100
Distributing Houses: "Distribution by Western Electric Company" by Alvin von Auw—7 photos	Au	112
"Distribution by Western Electric Company" by Alvin von Auw—7 photos	Au	113
Dittmer, A. M.: Group portrait	Au	163
Dixon, A. F.: Early telephone research	Au	167
"Dr. Bell's Telephone Service"	Au	174

E

Ellsworth, James D.: Portrait	Sp	31
Emblems: "How Angus Hibbard designed the Blue Bell"	Su	106
Emergencies:		
"Forest Fire: What an Unchecked Holocaust Wrought in Maine" by Timothy P. Mannix—9 photos	Wi	221
New Year's ice storm damages telephone plant	Wi	251
"Sleet Storms"	Su	105

	Issue	Page
Employee Morale—Recreational Facilities: "Employees Enjoy more than 70 Out-of-hour Activities" by John G. Simmons—10 photos	Su	81
Employees:		
"The Biggest Offer Ever" by Frederick A. Wiseman—8 photos	Wi	242
Excerpt from speech by Walter S. Gifford to International Telecommunication Conference, July 12, 1947	Wi	252
"How Big Are the Little Things In the Telephone Business?" by Keith S. McHugh	Au	124
"Employees Enjoy More than 70 Out-of-hour Activities" by John G. Simmons—10 photos	Su	81
Engineering: "Excursion in Engineering" by Carroll O. Bickelhaupt	Au	136
"Excursion in Engineering" by Carroll O. Bickelhaupt	Au	136
"Experimental Broadcasting Service"	Au	175
"Experimental Broadcasting Station"	Su	105

F

Facsimile: "Weather Charts by Wire For the Air Force" by Harry Jeavons—6 photos, 2 maps, 2 charts	Wi	228
Finance: "The Biggest Offer Ever" by Frederick A. Wiseman—8 photos	Wi	242
Fires: "Forest Fire: What an Unchecked Holocaust Wrought in Maine" by Timothy P. Mannix—9 photos	Wi	221
"The First Twenty-Five Years"—6 photos	Sp	30
Foley, Edward M., Jr.:		
Biographical sketch—portrait	Sp	68
"Preparing a History of the Telephone in Connecticut"—8 photos	Sp	56
Forest Fire: "What an Unchecked Holocaust Wrought in Maine" by Timothy P. Mannix—9 photos	Wi	221
"From Edinburgh"	Sp	66
Frost, Herrick P.: Connecticut telephone pioneer	Sp	57

G

Gifford, Walter S.:		
Biographical sketch	Sp	67
Excerpt from speech to International Telecommunication Conference, July 12, 1947	Wi	252
Made call opening New York-Boston radio relay system	Wi	204
"Mr. Bell and the Bell Laboratories" by Oliver E. Buckley—3 group portraits, 1 map	Sp	6
Opens overseas service to London; speaks around the world—2 portraits, 7 photos, 3 charts	Sp	37
"The Pioneers and the First Pioneer"—3 photos	Sp	21
Portrait	Sp	5
Portrait	Su	107

Issue Page

Presided at International Communication Conference Dinner ....Wi 202
"The Responsibility of Management in the Bell System" ...Su 70
Telephone Hour, March 3, 1947—group portrait ....Sp 18
"A Tribute Paid to Alexander Graham Bell During the Bell Centennial" by Walter S. Gifford—2 portraits ....Sp 4

Gilliland, Ezra T.: In Charge of Mechanical Dept., American Bell Telephone Company, 1884–1885 ....Au 155

Good Usage: "Helping Customers Improve Telephone Usage Habits" by Justin E. Hoy—7 photos, 1 chart ....Su 72

Government Ownership: Charts—Ownership of the world's telephones, January 1, 1947 ....Au 140

Grosvenor, Mrs. Gilbert H.: Letter from President Truman paying tribute to her father, Alexander G. Bell ....Sp 2

H

Hall, A. F.: Group portrait ....Au 163

"**Hammond V. Hayes: 1860–1947**" by Roger B. Hill and Thomas Shaw, with an introductory note by W. H. Harrison—10 photos, 3 charts ....Au 150

Harrell, J. E.: "The Heritage of the Pioneers" ....Sp 22

Harrison, William H.: "Hammond V. Hayes: 1860–1947" by Roger B. Hill and Thomas Shaw, with an introductory note by W. H. Harrison—10 photos, 3 charts ....Au 150

Hayes, Hammond V.: "Hammond V. Hayes: 1860–1947" by Roger B. Hill and Thomas Shaw, with an introductory note by W. H. Harrison—10 photos, 3 charts, portrait ..Au 150

Hayward, William H.: Connecticut telephone pioneer ....Sp 57

Head Sets: "Plastics—Their Growing Use in Telephone Plant" by John R. Townsend—6 photos ....Au 127

Hebb, T. C.: Research on Telephone amplifier ....Au 166

"**Helen Keller and Dr. Bell**" ....Sp 29

"**Helping Customers Improve Telephone Usage Habits**" by Justin E. Hoy—7 photos, 1 chart ....Su 72

Hibbard, Angus: "How the Blue Bell Was Designed" ....Su 106

Hill, Roger B.: Biographical sketch—portrait ....Au 111, 176

Hill, Roger B. and Thomas Shaw: "Hammond V. Hayes: 1860–1947" by Roger B. Hill and Thomas Shaw, with an introductory note by W. H. Harrison—10 photos, 3 charts ....Au 150

History: See **Telephones—History**

Holt, Richard B.:
"'Arms of the Law'—Police Communications"—8 photos, 1 map ....Wi 208
Biographical sketch—portrait ....Wi 178

"**How Big Are the Little Things In the Telephone Business?**" by Keith S. McHugh ....Au 124

	Issue	Page
Hoy, Justin E.:		
Biographical sketch—portrait	Su	107
"Helping Customers Improve Telephone Usage Habits"—7 photos, 1 chart	Su	72
Hoyt, R. S.: Early telephone research	Au	173
I		
"The International Telecommunication Conference of 1947" by Bartlett T. Miller—7 photos, 1 chart	Wi	192
J		
Jeavons, Harry:		
Biographical sketch—portrait	Wi	179
"Weather Charts by Wire for the Air Force"—6 photos, 4 maps	Wi	228
Jewett, F. B.: Early telephone research	Au	173
K		
"Keeping Our Automotive Equipment Modern" by Temple C. Smith—14 photos	Su	90
"Keeping Our Sights High" by Keith S. McHugh	Wi	191
Keller, Helen: "Helen Keller and Dr. Bell"	Sp	29
Kelvin, Lord: Quote on Bell's telephones at Centennial, 1876	Au	139
L		
Labor Relations: "The Responsibility of Management in the Bell System" by Walter S. Gifford	Su	70
Lacy, T. N.: "The Span of a Single Lifetime"	Sp	23
Lewis, Frederick Parker: Connecticut telephone pioneer	Sp	62
Lewis, Walter: First President of the District Telephone Company of New Haven—portrait	Sp	57, 58
Long Distance—Operator Dialing: "Nation-wide Operator Toll Dialing—the Coming Way" by Ralph I. Mabbs—4 photos, 1 map	Wi	181
Long Lines Department:		
"America Is Calling" by William G. Thompson—9 photos, 2 maps, 2 charts	Sp	35
"Nation-wide Operator Toll Dialing—the Coming Way" by Ralph I. Mabbs—4 photos, 1 map	Wi	181
"Weather Charts by Wire For the Air Force" by Harry Jeavons—6 photos, 2 maps, 2 charts	Wi	228
M		
Mabbs, Ralph I.:		
Biographical sketch—portrait	Wi	178
"Nation-wide Operator Toll Dialing—the Coming Way"—4 photos, 1 map	Wi	181
"Machine Switching in New York City"	Wi	240

	Issue	Page
Management:		
"Distribution by Western Electric Company" by Alvin von Auw—7 photos	Au	113
"How Big Are the Little Things in the Telephone Business?" by Keith S. McHugh	Au	124
"The Responsibility of Management in the Bell System" by Walter S. Gifford	Su	70
Mannix, Timothy P.:		
Biographical sketch—portrait	Wi	179
"Forest Fire: What an Unchecked Holocaust Wrought in Maine" by Timothy P. Mannix—9 photos	Wi	221
Manship, Paul: Bust of Alexander Graham Bell	Sp	6
Maps:		
Air Force Weather Map facsimile network provided by the Long Lines Department	Wi	229
Around the world circuit used by Mr. Gifford	Sp	38
The Bell System's coaxial cable and radio relay routes between Washington and Boston	Wi	205
Numbering-plan areas and their codes in the United States and Canada	Wi	188
Original copy of map prepared for facsimile transmission, and same map as received	Wi	230, 231
Overseas Radio Telephone Service From the United States	Sp	36
Pennsylvania State Police radiotelephone system	Wi	210
Round the States Telephone Circuit for Bell Centennial	Sp	10
"Mark Twain and the Telephone"—illus.	Su	100
Martin, Frank: Group portrait	Au	163
McBerty, F. R.: Early telephone research	Au	167
McGowan, James R.:		
Biographical sketch—portrait	Au	176
"Telephones in the World of 1947"—8 charts	Au	139
McHugh, Keith S.:		
Biographical sketch—portrait	Au	110
Biographical sketch—portrait	Wi	178
"How Big Are the Little Things In the Telephone Business?"	Au	124
"Keeping Our Sights High"	Wi	191
McQuarrie, J. L.: Early telephone research	Au	167
Michigan Bell Telephone Company: "Preparing Histories of the Telephone Business" by Samuel T. Cushing	Sp	53
Miller, Bartlett T.:		
Biographical sketch—portrait	Wi	178
"The International Telecommunication Conference of 1947"—7 photos, 1 chart	Wi	192
Miller, Theodore G.: Speaks on around the world circuits—portrait	Sp	37, 39
"Mr. Bell and the Bell Laboratories" by Oliver E. Buckley—4 photos, 1 map	Sp	6

Issue Page

Mobile Telephone Service:
"'Arms of the Law'—Police Communications" by Richard B. Holt—8 photos, 1 map ..... Wi 208
"Keeping Our Automotive Equipment Modern" by T. C. Smith—2 photos ..... Su 94
Molina, E. C.: Early telephone research ..... Au 167, 173
Morris, R. W.: Early telephone research ..... Au 173
Motion Pictures:
"Helping Customers Improve Telephone Usage Habits"—7 photos, 1 chart ..... Su 72
"Mr. Bell." Premiere at Bell Telephone Laboratories, March 3, 1947 ..... Sp 6
"Mr. Bell." Still from film ..... Sp 26
Motor Vehicles: "Keeping Our Automotive Equipment Modern" by Temple C. Smith—14 photos ..... Su 90

N

"Nation-wide Operator Toll Dialing—the Coming Way" by Ralph I. Mabbs—4 photos, 1 map ..... Wi 181
"A National Telephone Service" from an address by the late Harry B. Thayer ..... Wi 241
"The New Bell Telephone"—1 photo ..... Au 149
New York Telephone Company: "Machine Switching in New York City" ..... Wi 240
Numbering Plan: "Nation-wide Operator Toll Dialing—the Coming Way" by Ralph I. Mabbs—4 photos, 1 map .... Wi 184

O

O'Donnell, J. W.: Group portrait ..... Au 163
Ogden, Floyd P.: "Two Kinds of Pioneering" ..... Sp 24
"Opening of New York–Boston Radio Relay System Is Historic Event"—1 map, 2 photos ..... Wi 204
O & E Department: "Hammond V. Hayes: 1860–1947" by Roger B. Hill and Thomas Shaw ..... Au 150
Operators:
"Forest Fire: What an Unchecked Holocaust Wrought in Maine" by Timothy P. Mannix—9 photos ..... Wi 221
"Nation-wide Operator Toll Dialing—the Coming Way" by Ralph I. Mabbs—4 photos, 1 map ..... Wi 181
Organization: Development of organization of O. & E. Department ..... Au 169
Overseas Telephone Service:
"America Is Calling" by William G. Thompson—9 photos, 2 maps, 2 charts ..... Sp 35
"The International Telecommunication Conference of 1947" by Bartlett T. Miller—7 photos, 1 chart ..... Wi 192

Issue Page

P

Page, Arthur W.: Quote from book "The Bell Telephone System" on the evolutionary process of improving telephone plant ....Su 99
Patents: Loading coil patent issued to M. I. Pupin ....Au 163
"The Pioneers and the First Pioneer"—3 photos ....Sp 21
Plant Department:
"Keeping Our Automotive Equipment Modern" by Temple C. Smith—14 photos ....Su 90
Quote from book "The Bell Telephone System" by Arthur W. Page on renewing telephone plant ....Su 99
"Plastics—Their Growing Use in Telephone Plant" by John R. Townsend—6 photos ....Au 127
Poetry: "The Teacher" by A. M. Sullivan ....Sp 3
Policies: "The Responsibility of Management in the Bell System" by Walter S. Gifford ....Su 70
"Preparing a History of the Telephone in Connecticut" by Edward M. Foley, Jr.—8 photos ....Sp 56
"Preparing Histories of the Telephone Business" by Samuel T. Cushing ....Sp 52
Private Branch Exchange: "'Arms of the Law'—Police Communications" by Richard B. Holt—8 photos, 1 map ....Wi 208
Public Relations: "How Big Are the Little Things In the Telephone Business?" by Keith S. McHugh ....Au 124
Pupin, M. I.: Granted loading coil patent ....Au 163

R

Radio Relay System: "Opening of New York–Boston Radio Relay System Is Historic Event"—1 map, 2 photos ....Wi 204
Radio Stations:
"Experimental Broadcasting Service" ....Au 175
"Experimental Broadcasting Station" ....Su 105
Radio Telephony:
"America Is Calling" by William G. Thompson—9 photos, 2 maps, 2 charts ....Sp 35
"'Arms of the Law'—Police Communications" by Richard B. Holt—8 photos, 1 map ....Wi 208
"The International Telecommunication Conference of 1947" by Bartlett T. Miller—7 photos, 1 chart ....Wi 192
"Keeping Our Automotive Equipment Modern" by Temple C. Smith—2 photos ....Su 94
Radio—Transoceanic:
"America Is Calling" by William G. Thompson—9 photos, 2 maps, 2 charts ....Sp 35
Excerpt from speech by W. S. Gifford to International Telecommunication Conference, July 12, 1947 ....Wi 252
"The International Telecommunication Conference of 1947" by Bartlett T. Miller—7 photos, 1 chart ....Wi 192

Issue Page

Rates—Telephone:
Comment on rate reductions, A. T. & T. Annual Report, 1905 ..... Au 170
Overseas telephone rates, 1927–1946—chart ..... Sp 49
Research:
"Hammond V. Hayes: 1860–1947" by Roger B. Hill and Thomas Shaw, with an introductory note by W. H. Harrison—10 photos, 3 charts ..... Au 150
"Plastics—Their Growing Use in Telephone Plant" by John R. Townsend ..... Au 127
"The Responsibility of Management in the Bell System" by Walter S. Gifford ..... Su 70
Rhodes, F. L.: Early telephone research ..... Au 173
Richards, W. L.: Early telephone research ..... Au 173

S

Sargent, W. D.: Demonstrated advantages of paper as cable insulation, 1888 ..... Au 157
Scribner, C. E.: Helped invent common-battery system ..... Au 160
Shaw, Thomas: Biographical sketch—portrait ..... Au 111, 176
Shaw, Thomas and Roger B. Hill: "Hammond V. Hayes: 1860–1947" by Roger B. Hill and Thomas Shaw, with an introductory note by W. H. Harrison—10 photos, 3 charts .. Au 150
Shreeve, H. E.:
Early telephone research ..... Au 173
Invented repeater ..... Au 165
Simmons, John G.:
Biographical sketch—portrait ..... Su 107, 108
"Employees Enjoy more than 70 Out-of-hour Activities"—10 photos ..... Su 81
"Sleet Storms" ..... Su 105
Smith, Temple C.:
Biographical sketch—portrait ..... Su 108
"Keeping Our Automotive Equipment Modern"—14 photos .. Su 90
Southern New England Telephone Company:
"Preparing a History of the Telephone in Connecticut" by Edward M. Foley, Jr.—8 photos ..... Sp 56
"Preparing Histories of the Telephone Business" by Samuel T. Cushing ..... Sp 52
Southwestern Bell Telephone Company: "Preparing Histories of the Telephone Business" by Samuel T. Cushing ..... Sp 52
Stockholders:
"The Responsibility of Management in the Bell System" by Walter S. Gifford ..... Su 70
"The Biggest Offer Ever" by Frederick A. Wiseman—8 photos ..... Wi 242
Stone, John S.:
Patented "bi-metallic wire" cable ..... Au 162
Telephone relay experiments ..... Au 166

	Issue	Page
Storms:		
New Year's ice storm damage to telephone plant	Wi	251
"Sleet Storms"	Su	105
Sullivan, A. M.: "The Teacher"—Poem	Sp	3

T

"The Teacher" by A. M. Sullivan—Poem	Sp	3
Telegraph: Charts—Telephone conversations and telegrams, Year 1946	Au	145
Telephone Centers: "America Is Calling" by William G. Thompson—9 photos, 2 maps, 2 charts	Sp	35
Telephone Development:		
Chart—Telephone development of large cities, January 1, 1947	Au	146
Chart—Telephone development of the world, by countries, January 1, 1947	Au	142
"Telephones in the World of 1947" by James R. McGowan—8 charts	Au	139
Telephone Hour:		
"A Tribute Paid to Alexander Graham Bell During the Bell Centennial" by Walter S. Gifford, March 3, 1947	Sp	4
"Two Men and a Piece of Wire—*and Faith*"—7 photos	Sp	12
Telephone Pioneers of America:		
Active in social field	Su	83
"The Pioneers and the First Pioneer"—3 photos	Sp	21
"Preparing a History of the Telephone in Connecticut" by Edward M. Foley, Jr.—8 photos	Sp	56
"Preparing Histories of the Telephone Business" by Samuel T. Cushing	Sp	52
Telephone Service:		
Excerpt from speech by Walter S. Gifford to International Telecommunication Conference, July 12, 1947	Wi	252
"How Big Are the Little Things in the Telephone Business?" by Keith S. McHugh	Au	124
"Keeping Our Sights High" by Keith S. McHugh	Wi	191
"A National Telephone Service" from an address by the late Harry B. Thayer	Wi	241
Telephones:		
Chart—Telephone conversations and telegrams, Year 1946	Au	145
Chart—Telephones per 100 population, January 1, 1947	Au	144
Chart—The World's telephones by continental areas, January 1, 1947	Au	141
"Plastics—Their Growing Use in Telephone Plant" by John R. Townsend—6 photos	Au	127
Telephones—Foreign Countries:		
Chart—Distribution of the world's telephones, January 1, 1947	Au	141
Chart—Ownership of the world's telephones, January 1, 1947	Au	140

Issue Page

Chart—Telephone development of large cities, January 1, 1947 ....Au 146
Chart—Telephone development of the world, by countries, January 1, 1947 ....Au 142
Chart—Telephones per 100 population, January 1, 1947 ....Au 144
Chart—The World's telephones by continental areas, January 1, 1947 ....Au 141

Telephones—History see also **Bell, A. G.:**
"America Is Calling" by William G. Thompson—9 photos, 2 maps, 2 charts ....Sp 35
"The Bell Centennial in the Press"—2 photos ....Sp 25
"Crossed Wireless" ....Su 104
"The First Twenty-Five Years"—6 photos ....Sp 30
"Hammond V. Hayes: 1860–1947" by Roger B. Hill and Thomas Shaw, with an introductory note by W. H. Harrison—10 photos, 3 charts ....Au 150
"Mark Twain and the Telephone"—illus. ....Su 100
"Mr. Bell and the Bell Laboratories" by Oliver E. Buckley —4 photos, 1 map ....Sp 6
"The New Bell Telephone"—1 photo ....Au 149
"Opening of New York–Boston Radio Relay System is Historic Event"—1 map, 2 photos ....Wi 204
"The Pioneers and the First Pioneer"—3 photos ....Sp 21
"Preparing a History of the Telephone in Connecticut" by Edward M. Foley, Jr.—8 photos ....Sp 56
"Preparing Histories of the Telephone Business" by Samuel T. Cushing ....Sp 52
Quote by Sir William Thomson (Lord Kelvin) on Bell's Telephones at Centennial, 1876 ....Au 139
"Telephones in the World of 1947" by James R. McGowan—8 charts ....Au 139
"Twenty-five Years Ago in the Bell Telephone Quarterly, July 1922" ....Su 105
"Twenty-five Years Ago in the Bell Telephone Quarterly, Oct. 1922" ....Au 174
"Twenty-five Years Ago in the Bell Telephone Quarterly, Jan. 1923" ....Wi 240
"Two Men and a Piece of Wire—*and Faith*"—7 photos ....Sp 12

Telephones—Statistics:
Chart—The World's telephones by continental areas, January 1, 1947 ....Au 141
"Telephones in the World of 1947" by James R. McGowan —8 charts ....Au 139
"World's Telephone Statistics, 1921" ....Au 175

"Telephones in the World of 1947" by James R. McGowan —8 charts ....Au 139

Teletypewriters:
"America Is Calling" by William G. Thompson—9 photos, 2 maps, 2 charts ....Sp 35

	Issue	Page
"'Arms of the Law'—Police Communications" by Richard B. Holt—8 photos, 1 map	Wi	208
"Weather Charts by Wire for the Air Force" by Harry Jeavons—6 photos, 3 maps, 1 chart	Wi	228
Thayer, Harry B.:		
"The First Twenty-Five Years"—5 photos, portrait	Sp	30
"A National Telephone Service" excerpt from an address	Wi	241
Thompson, G. K.:		
Early telephone research	Au	173
Group portrait	Au	163
Thompson, William G.:		
"America Is Calling"—9 photos, 2 maps, 2 charts	Sp	35
Attended International Telecommunication Conference	Wi	203
Biographical sketch—portrait	Sp	67, 68
Thomson, Sir William (Lord Kelvin): Quote on Bell's telephones at Centennial, 1876	Au	139
Toll Dialing: "Nation-wide Operator Toll Dialing—the Coming Way" by Ralph I. Mabbs—4 photos, 1 map	Wi	181
Toomey, J. F.: Early telephone research	Au	173
Townsend, John R.:		
Biographical sketch—portrait	Au	110
"Plastics—Their Growing Use in Telephone Plant"—6 photos	Au	127
Treasury Department: "The Biggest Offer Ever" by Frederick A. Wiseman—8 photos	Wi	242
"A Tribute Paid to Alexander Graham Bell During the Bell Centennial" by Walter S. Gifford—2 portraits	Sp	4
Truman, Harry S.: Letter from President Truman to Mrs. Grosvenor on Bell Centennial—1 photo	Sp	2
Twain, Mark: "Mark Twain and the Telephone"—illus.	Su	100
"Twenty-five Years Ago in the Bell Telephone Quarterly, July 1922"	Su	105
"Twenty-five Years Ago in the Bell Telephone Quarterly, Oct. 1922"	Au	174
"Twenty-five Years Ago in the Bell Telephone Quarterly, Jan. 1923"	Wi	240
"Two Men and a Piece of Wire—*and Faith*"—7 photos	Sp	12
Tyler, Morris F.: Chapter of telephone pioneers	Sp	57

U

United States Independent Telephone Association: "Keeping Our Sights High" by Keith S. McHugh	Wi	191

V

Vacuum Tubes: "Plastics—Their Growing Use in Telephone Plant" by John R. Townsend—photo	Au	130
Verity, R. C.: "Teacher and Humanitarian"	Sp	23

	Issue	Page
von Auw, Alvin:		
Biographical sketch—portrait	Au	110
"Distribution by Western Electric Company"—7 photos	Au	113

W

Waterson, K. W.: Early telephone research	Au	169, 173
Warren, H. S.:		
Loading coil experiments	Au	164
Early telephone research	Au	173
Watson, Thomas A.:		
"Crossed Wireless"	Su	104
"Two Men and a Piece of Wire—*and Faith*"—7 photos	Sp	12
"Weather Charts by Wire For the Air Force" by Harry Jeavons —6 photos, 3 maps, 1 chart	Wi	228
Western Electric Company:		
"Distribution by Western Electric Company" by Alvin von Auw—7 photos	Au	113
New Year's ice storm damages telephone plant	Wi	251
"Plastics—Their Growing Use in Telephone Plant" by John R. Townsend—6 photos	Au	127
Whittemore, Laurens E.: Attended International Telecommunication Conference	Wi	197
Wilkins, J. B.: Group portrait	Au	163
Wire:		
"Hammond V. Hayes: 1860–1947" by Roger B. Hill and Thomas Shaw, with an introductory note by W. H. Harrison—10 photos, 3 charts	Au	150
"Plastics—Their Growing Use in Telephone Plant" by John R. Townsend—6 photos	Au	127
Wiseman, Frederick A.:		
"The Biggest Offer Ever"—8 photos	Wi	242
Biographical sketch—portrait	Wi	179
World War II: "America Is Calling" by William G. Thompson —9 photos, 2 maps, 2 charts	Sp	35
"World's Telephone Statistics, 1921"	Au	175

lume XXVI Number One Spring 1947

Tel MAGAZINE

ANNIVERSARY ISSUE

erican Telephone & Telegraph Company · New York

Bell Telephone *Magazine*

Spring 1947

The Teacher, *A. M. Sullivan*, 3

A Tribute to Alexander Graham Bell, *Walter S. Gifford*, 4

Mr. Bell and Bell Laboratories, *Oliver E. Buckley*, 6

Two Men and a Piece of Wire—and Faith, 12

The Pioneers and the First Pioneer, 21

The Bell Centennial in the Press, 25

Helen Keller and Dr. Bell, 29

The First Twenty-Five Years, *The Editors*, 30

America Is Calling, *William G. Thompson*, 35

Preparing Histories of the Telephone Business, *Samuel T. Cushing*, 52

Preparing a History of the Telephone in Connecticut, *Edward M. Foley, Jr.*, 56

Who's Who & What's What, 67

A Medium of Suggestion & a Record of Progress

Published for the supervisory forces of the Bell System by the Information Department of American Telephone and Telegraph Co., *195 Broadway, New York 7, N. Y.*
Walter S. Gifford, *Pres.;* Carroll O. Bickelhaupt, *Sec.;* Donald R. Belcher, *Treas.*

THE WHITE HOUSE
WASHINGTON

February 20, 1947

Dear Mrs. Grosvenor:

I am delighted to have a part in honoring the memory of your father on the one hundredth anniversary of his birth on March third.

Alexander Graham Bell is known to all of us not only as one of the world's outstanding inventors, but as a distinguished citizen who gave unstintingly of his heart and talents to the cause of a better world. The spirit of service to his fellow men motivated his entire life.

This country is great because men like your father helped make it so. I should like you to know how happy I am, in his Centennial year, to voice our nation's tribute.

Very sincerely yours,

Harry Truman

Mrs. Gilbert H. Grosvenor,
"Wild Acres,"
Bethesda 14,
Maryland.

A similar letter was sent to Mr. Bell's other daughter, Mrs. David Fairchild, in Miami

The Teacher

A tribute to Alexander Graham Bell

A. M. SULLIVAN

I

He loved the spoken word,
The beauty of the thing;
He gave the word a wing
And taught the word to fly
Till human sound is heard
Around the earth and sky.

II

He taught men better speech,
And better than his dream
He probed the airy scheme
And gave the tongue of men
A long triumphant reach
Beyond the human ken.

III

The word and then the spark,
The magnet and the sound,
And this is what he found
When he touched the distant ear:
That faith will find its mark
And ring out loud and clear.

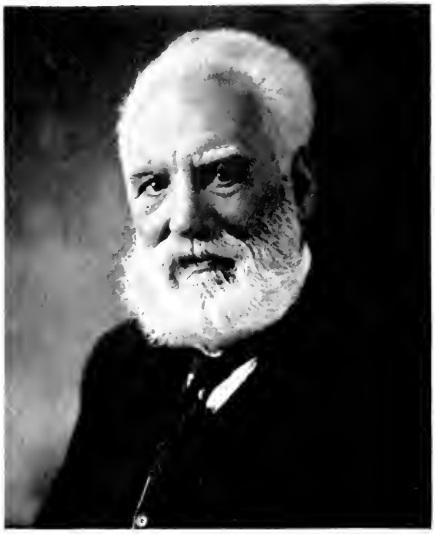
IV

Swift as a magic arrow
The first few words were sent
And the cry turned eloquent
Through fifty feet of wire,
And the words burned through its marrow
With syllables of fire.

V

He loved the human voice
And made the welkin ring
With the beauty of the thing
And the meaning of the word,
And a host of men rejoice
That they listened and they heard.

Mr. Sullivan is a former president of the Poetry Society of America, and the author of "Stars and Atoms Have No Size," "A Day in Manhattan," and other volumes



The Moffett photographic portrait of Alexander Graham Bell in later life. A large print of it occupied a place of honor above the stage during the presentation of the Telephone Hour on March 3

A Tribute Paid to Alexander Graham Bell

We do honor tonight to the memory of a man whose imagination and genius changed fundamentally man's relationship to man. In helping the deaf, he discovered the way that has made it possible for men to hear and talk to one another around the world.

Before his invention, people could talk with one another only in the same room or nearby. Today, anybody, anywhere in this country, can talk with practically anybody anywhere else in the United States and, for that matter, with people in almost every nation in the world. Distance has been eliminated as a barrier to conversation, and the miracle of the telephone has made a single neighborhood of our entire country.

We Americans can be proud and also grateful that when Alexander Graham Bell came to the United States as a young man he was able to give full play to his creative imagination in our atmosphere of freedom. Here his invention was a seed planted in the fertile soil of a land of opportunity.

In our representative democracy and under our system of private enterprise, free from the stifling effects of a planned economy, the growth and development of the telephone has led the world. The telephone's astounding progress here is the result of individual initiative and ability. These have been given free rein over the years in the organization which bears Mr. Bell's name and which rec-

President Walter S. Gifford of the A. T. & T. Co., photographed just before the Telephone Hour went on the air. His tribute to the memory of Mr. Bell was the high point of the program

by Walter S. Gifford

during the Bell Centennial

ognizes the American ideal of respect for the individual and of equal opportunity for each to develop his talents to the fullest.

Mr. Bell was a pioneer in aviation as well as the father of telephony. Great as his achievements were, it is not for them alone that he commands our deepest respect. The mainspring of his life was the desire to serve humanity. He thought of himself as a teacher of the deaf, and as long as he lived he was devoted to the cause of lightening their burden.

It was my good fortune to know him, and to gain a personal sense of how great a man he was. I first met him in 1917, when he was seventy years old. I was at once impressed by his charming personality, his wisdom, his enthusiasm, and his inquiring interest in the world about him. Yet uppermost in my memory of Mr. Bell is the recollection of his great kindliness and his concern for the welfare of others. To me, it is a happy and inspiring thing that in the character of the inventor of the telephone, we should find just those human qualities that contribute most to the character of telephone service.

His spirit of service has lighted the way for telephone men and women everywhere, and has become a tradition with us in the Bell System. This tradition is our most appropriate memorial to the man we honor in this centennial year of his birth.

Mr. Bell and the Bell Laboratories

BEFORE there was a telephone, there was a telephone laboratory, as the present Bell Telephone Laboratories frequently point out, and the day-time ceremonies of the Bell Centennial observance were focussed in the Murray Hill, N. J., laboratories of that organization. There, on March 3, 1947, more than a score of Mr. Bell's descendants were entertained, and several took part in activities arranged to do honor to their distinguished ancestor.

Walter S. Gifford, President of the American Telephone and Telegraph Company, welcomed the guests, and introduced Dr. Oliver E. Buckley, President of the Bell Telephone Laboratories. At the conclusion of Dr. Buckley's remarks, which are given below, Mrs. Gilbert Grosvenor, daughter of Mr. Bell, unveiled a heroic bust of her father which had been executed in terra cotta by Paul Manship. The bust stands on an eight-foot mahogany pedestal in the main entrance lobby at Murray Hill.

Three Bell generations then took part in the longest land-line telephone hook-up ever established. The circuit extended from Murray Hill through New York, Miami, New Orleans, El Paso, Los Angeles, San Francisco, Seattle, Minneapolis, Chicago, Buffalo, Bangor, Boston, and again New York and back to Murray Hill. Mrs. Grosvenor and Mrs. Leonard Muller, a granddaughter of Mr. Bell, conversed over this 10,000-mile circuit from adjacent booths and Mrs. David Fairchild, his other daughter, joined in the conversation at Miami. President Truman's letter of tribute, reproduced on page 2, was read over this around-the-nation circuit. Other members of the Bell family listened through earphones and some of the younger ones took turns at the telephones.

After these events, the group toured the Laboratories, and then were Dr. Buckley's guests at luncheon. In the afternoon they gathered in the auditorium to view a premiére of the A. T. & T. Company's Bell Centennial motion picture, "Mr. Bell."

Address of Dr. Oliver E. Buckley

at the unveiling of the Paul Manship bust of Alexander Graham Bell, Murray Hill, N. J., March 3, 1947

WE HAVE ASSEMBLED here today to do honor to Alexander Graham Bell, the inventor of the telephone, who was born just one hundred years ago in Edinburgh, Scotland. Joining with us, the members of the telephone family, are members of Dr. Bell's own family, including his descendants down to the fourth generation.

As father of the telephone, Dr.

Bell has a kind of family relationship to all of us whose lives are intimately bound to the instrument which he created. All who are part of the Bell System can claim that relationship, but we who are members of Bell Telephone Laboratories have a special claim. We are truly the spiritual descendants of Dr. Bell, for it is our privilege and responsibility today to carry forward the torch of scientific inquiry which 70 years ago led him to the concept of the telephone.

THIS FOREBEAR of ours is one in whom we can take great pride, for his greatness is not alone measured by the invention of the telephone which most brought him his fame.

He was an enthusiastic teacher and made outstanding contributions to methods of teaching the deaf.

He was a great leader, as exemplified by his record as President of the National Geographic Society and his organization of the Volta Bureau.

He was a man of unusual vision, who could see far into the future, as evidenced not only by his early prediction of the extension of telephony but also by his confidence in the practical possibilities of aviation at a time when contemporary scientists were skeptical.

He was practical as well as imaginative. His facile mind led him to explore many trails but always with an eye to practical application and most often concerned with human welfare; for above all he was a great humanitarian, beloved by all who knew him.

One of the many trails along which his curiosity led him was that of practical genetics, his interest having been aroused by his observations on the hereditary aspects of congenital deafness. Attracted as he was to the study of heredity, it seems likely that Dr. Bell, if he were here today, might look on the telephone itself and Bell Telephone Laboratories as notable examples of inheritance and evolution, the modern telephone as a descendant of his own brain child and Bell Telephone Laboratories as a descendant of the attic laboratory of himself and Watson in which the telephone was born.

The unveiling. Mrs. Gilbert Grosvenor, a daughter of Alexander Graham Bell, reveals an heroic bust of her father as a young man, executed in terra cotta by Paul Manship, as President Oliver E. Buckley of Bell Telephone Laboratories and President Walter S. Gifford of the A. T. & T. Company look on

From Dr. Bell's original telephone instrument have sprung the fifty mil-

Before the sculpture stand Dr. Buckley, Mr. Gifford, Mrs. Grosvenor, and Gardiner H. Myers and Midshipman Alexander Graham Bell Grosvenor, great-grandsons of the telephone's inventor

lion or more telephones in use today. Descendants of that first telephone are to be found all over the world. There are great variations among them, but all bear evidence of their common ancestry. Growth in numbers has been paralleled in time by rapid evolution in design. The telephone has changed over the years and become progressively a better instrument as new knowledge and new methods of operation have been incorporated in it.

However, we cannot appropriately treat of telephones as individuals. A telephone instrument by itself has little value or usefulness. It is useful only when associated with another telephone and a line to connect them, and its value increases the greater the number of instruments with which it can be connected.

More striking even than the evolution of the telephone instrument itself is the evolution of telephone systems which have built for society a great network binding together telephones everywhere and making possible the rapid worldwide flow of thought. This network has become, indeed, the nervous system of modern society, quite analogous to the nervous system that serves the human body. The telephone instrument itself is merely the nerve-ending of this system. Many of its parts are hidden or buried; they are to be found in great cables carrying thousands of wires beneath city streets and in huge central office buildings that house the complex switching centers of the system.

As THE telephone system has evolved, so has there been an evolution in the telephone laboratories which have been the main source from which improvements in telephony have come. The original Bell Telephone Laboratory with its team of two workers has grown to a great institution for research and development with a team of 6000 workers.

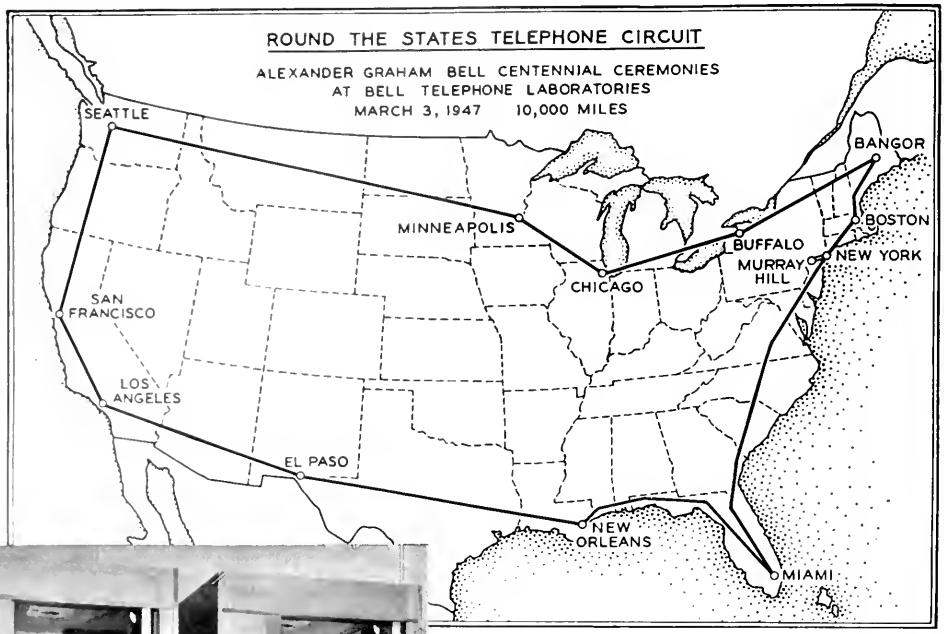
Only about 1000 of that number are located in the building where we are now assembled, and perhaps the best way to envisage the size of today's Laboratories is to look at this building and multiply it by six.

Such an institution cannot be built in a day, and this one has been the product of gradual growth as the needs for its services have expanded and the way to provide them has become evident from experience. There have been changes in form and in pattern of organization. There have been changes in methods. There have been changes in materials from which we build. There has been a rapidly expanding stream of new scientific knowledge flowing from universities and other sources of science research. But in all this welter of change there has been one steady purpose for Bell Telephone Laboratories: always it has been to apply research and invention to the extension and perfection of electrical communication, creating the best facilities for economical telephone service that scientific knowledge makes possible.

This has called for a team of many skills: scientists to unearth new knowledge; inventors to devise new methods, systems, and appliances; designers to put the products of invention into form for economical manufacture; draftsmen and technical writers to translate ideas into precise specifications; mechanics to build models so that engineers could test new products under actual conditions of use—and all the other helpers, including accountants, typists, patent attorneys, and executives who join their efforts to this common end.

THE MEMBERS of this team have been carefully selected over a long period. The team combines the judgment and knowledge gained from years of experience with the enthusiasm of young minds versed in the newest scientific knowledge. It is more than a team of great skills and

Dr. Buckley leans forward to explain to a group of Mr. Bell's great-grandchildren the workings of a model of the liquid telephone transmitter, while Mr. Gifford looks on



'Round-the-nation conversation. Mrs. Leonard Muller (left), a granddaughter of Mr. Bell, and Mrs. Gilbert Grosvenor, a daughter, conversed with each other over the circuit sketched above, as part of the centennial observances at Bell Laboratories at Murray Hill, N. J.

ability; it is the custodian of an art and of a great tradition. A sense of personal responsibility pervades the whole organization, and all of us are proud of our magnificent inheritance.

Let us imagine what would most interest Dr. Bell if he could go with us today on a tour of Bell Telephone Laboratories. He would doubtless quickly comprehend and admire the improvements in the telephone instrument itself, and would find the answers to questions that had perplexed him in the design of its predecessors.

He would, I believe, be amazed at the complexity of the devices used in the modern art of machine switching. Indeed, he would find in it one of the most intricate machines ever designed by man, yet made responsive to the control of any telephone subscriber who chooses to dial a number.

Dr Bell would be impressed, I am sure, by the advances which have been made possible by electronic devices, the first of which were just coming into use in the later years of

his life. Though I doubt it would at all surprise him to find radio playing an important part in a modern telephone system, I believe that our present grouping together of great numbers of telephone conversations for simultaneous transmission over the same conductor or radio link surpasses anything he could have imagined in his lifetime.

He would be delighted, I am sure, in seeing the fundamental research work going on in the laboratory, and particularly our studies on visible speech. Here he would see the realization of the very object of one of his own researches that crystallized for him the idea of the telephone. He would see in it not only a scientific achievement but an effective tool for the teacher to use in instructing handicapped pupils to speak correctly. Indeed, if the tales I have heard of him are correct, he would probably execute an Indian war dance at this stage of his journey.

Doubtless, thoughout the whole trip he would admire the excellent facilities which his successors have at their disposal, contrasting them with the crude tools which were available to him.

But one aspect of Bell Telephone Laboratories would, I believe, at the end of the trip bring more favorable comment than any other, for it is so of almost every visitor and he would be more observant than most. That comment would be on the intelligence, alertness, and enthusiasm of the people working here. For he would know that it is on the personal qualities of its members, more than on anything else, that the success of a research and development group depends.

Fine buildings and good equipment are a help, good organization and leadership are important, but nothing counts so much as the presence of good men inspired by a sense of freedom in their work—a freedom that is limited only by its dedication to a high ideal of public service.

Dr. Bell would, I believe, be proud of those who have succeeded him in telephone research. The members of his family who honor us by their presence today can share that pride, as today they have the opportunity to see what has come from the laboratory their distinguished forebear started.

As an enduring reminder of this hundredth birthday of the inventor of the telephone, we have called on the services of the eminent sculptor Paul Manship to execute a likeness of Alexander Graham Bell as he appeared at about the time of his great invention.

On the pedestal which supports this likeness is a thought which came from the depths of Bell's own wisdom and experience. His words are simple and his imagery is homely. None the less, the faith which he expressed is dearly prized by every scientist. These few words of his will long remain an inspiration to us who work here. They read:

Leave the beaten track occasionally and dive into the woods. You will be certain to find something that you have never seen before.

Two Men and a Piece of Wire—*and Faith*

THE "TELEPHONE HOUR" radio program of March 3 took place on the hundredth anniversary of the birth of Alexander Graham Bell, and was dedicated "to his accomplishment and his vision of a greater America." Several members of the Bell family were in the studio audience as honored guests. The program occupied an hour instead of the usual 30 minutes, and Helen Traubel, soprano, and Jascha Heifetz, violinist, appeared with Donald Voorhees and the Bell Telephone Orchestra and Chorus. A "dramatic interlude," written by Norman Rosten, was presented by a cast headed by the noted actor Raymond Massey. In order to preserve something of the atmosphere of this part of the broadcast as the studio audience heard and saw it, the radio script is here given verbatim, Mr. Massey being the NARRATOR. *The Editors.*

OPERATOR 1 (FILTER)

New York calling Denver . . . calling St. Petersburg . . . Kansas City . . . Hartford (FADING) Philadelphia . . . Chicago . . .

NARRATOR

Easy, isn't it? You lift the receiver, ask for the operator . . .

OPERATOR 2 (FILTER)

Number please? One moment, please . . . (MUSIC UNDER)

NARRATOR

"One moment, please . . ." It's a matter of moments now. It's one hundred million miles of wire, with radio-telephone links overseas. It's a highly skilled organization of more than half a million men and women on the job day and night to serve you —serving America in a thousand ways, in crisis and everyday affairs.

(MUSIC HOLD)

VOICE 1 (MAN)

Watch-tower ten reporting. Hello. Brush fire a-running south by southwest. Wind up to thirty miles an hour.

VOICE 2 (WOMAN)

May I have Main 4-6000, please.

VOICE 3 (WOMAN)

Operator, please connect me with the nearest hospital.

VOICE 4 (MAN)

And say, Joe, I'd like to increase that order by twenty tons. How soon can you ship out of Chicago? Two days? Fine. (FADING) Give me a ring if there's any delay . . .

(MUSIC TO CHORD AND OUT)

NARRATOR

That's the familiar picture. That's part of our age. We're used to miracles today. But how about the birth of miracles? Mr. Shirley, would you read the opening paragraph of this sheet of paper, please?

SHIRLEY
(ANNOUNCER)

Of course. "The proprietors of the Telephone, the invention of Alexander Graham Bell, for which patents have been issued by the United States and Great Britain, are now prepared to furnish telephones for the transmission of articulate speech through instruments not more than twenty miles apart . . ." (PAUSE)

NARRATOR

It's all right—just read on, if you will.

SHIRLEY

(CLEARS HIS THROAT) "Conversation can be easily carried on after slight practice and with the occasional repetition of a word, or sentence. On first listening to the Telephone, though the sound is perfectly audible, the articulation seems to be indistinct; but after a few trials the ear becomes accustomed to the peculiar sound and finds little difficulty in understanding the words." Well!

NARRATOR

Mr. Shirley, you've just read the opening of the first Telephone advertisement, which appeared in Cambridge, Massachusetts, May, 1877, the year following Bell's first successful transmission of speech over wire. "Not more than twenty miles apart . . ." That makes us smile today, doesn't it? Always easy to look back and smile. (MUSIC COMES IN BEHIND)

What kind of country did we have in the 70's?
She was a sprawling and still green country,
On her way to big things, finding her power,
Fifty million people then, native and immigrant
Crowding the cities and spilling over to the open west.
Colorado was a new state in the Union,
Wyoming, Idaho and Utah were just territory
Waiting for the homesteaders—there was room for awhile!
Room for the dreamers, the kind who make their life
Out of wilderness and hope—the pioneers.
Around this time they had a thing called a bicycle,
Made of wood; and P. T. Barnum was going strong;
And a steamboat paddled from New Orleans to St. Louis
In less than four days—a record, they say.

(SOUND OF OLD TYPE RAILROAD WHISTLE APPROACHING)

The Union Pacific heading for the Utah territory,
With the Central Pacific coming the other way.
And at a place called Ogden, you may remember . . .

(SOUND: HAMMER ON A SPIKE)

They drove in the Golden Spike,

The Telephone Hour was 60 minutes long on March 3. This picture was made just before the program went on the air

Tied a strip of steel together,
Linking the continent all the way!

(SOUND OF THRESHING MACHINE)

Harvester and thresher walking the prairie;
Machines take over the vast spaces.

(SOUNDS: DERRICK, RIVETING, STEEL ROLLING MILL)

New sounds for America: sounds of construction:
Iron and steel echoing across the land:
Rolling steel for the spine of a nation!

(A LOW TWANGING SOUND OF THE PLUCKED VIBRATING REED USED ON BELL'S FIRST RECEIVER)

One moment, that sound . . . It almost went by.
Let's have that sound again, please.

(REPEAT THE SOUND)

A vibrating reed. A thin strip of magnetized steel
Sending tone and for the first time
Its overtone . . . faintly . . .

(SOUND: REPEAT STEADILY UNDER. MUSIC SNEAK TO SAME TUNE AND TEMPO)

Heard in the attic room of an old frame house
In Boston in the year 1875, and the man listening
Was Alexander Graham Bell. O this miracle

Specially invited guests, including members of the Bell family group, are at the right end of the balcony, in the biggest studio in Radio City

Not even to the height of a whisper,
And yet to his ear, tuned and trained,
This secret sound being sent from the next room
Had a meaning only he understood.

(MUSIC ABRUPTLY OUT)

BELL (EXCITEDLY)

Watson, where are you? Watson, are you there!

(SOUND: DOOR OPEN)

BELL

Watson . . .

WATSON

Yes, Mr. Bell? What is it?

BELL

What did you do? Don't change anything. Let me see.

WATSON

I plucked the vibrating reed . . . it seemed to stick. Like this.

(SOUND OF VIBRATING REED)

BELL

So . . . at last. This is the key, Mr. Watson. And the door we unlock next—who knows—may be the sending of human speech over a wire. It must be done. At least, we will try.

(MUSIC UNDER)

NARRATOR

Almost a year later, on March 10, 1876, Bell was at work in his room, seated near a transmitter, while Watson, his assistant, was several rooms away at the receiving end of a one-way line. It was just another day of tedious experimentation—testing, hoping, trying. As Bell leaned over the work-bench, his arm spilled some

Some of the members of the cast of the "dramatic interlude" presented during the Telephone Hour go over the script with Mr. Massey in rehearsal

battery acid on his clothes. He jumped up and called out . . .

(MUSIC OUT)

BELL

Mr. Watson, come here, I want you! (PAUSE) Hmmm. I've ruined this jacket. How did I ever . . .

(DOOR OPEN)

BELL

Yes, what is it, Mr. Watson? Have you seen a ghost?

WATSON

Mr. Bell, Mr. Bell . . . I heard every word you said—over the wire!

BELL

You . . . *heard?*

WATSON

"Mr. Watson, come here, I want you." I heard it distinctly! (PAUSE) That was the first sentence ever heard over the telephone, sir.

BELL

Not much of a sentence, was it?

(BELL LAUGHS EXCITEDLY. WATSON JOINS)

NARRATOR

Well, that's how it began. Two men and a piece of wire—and faith. Would it work? Soon this plaything, which many people called it, went into business, and the way you went about getting early telephone service was something like this . . . (MUSIC OUT)

HUBBARD

Now let's see, Mr. Emery. You have an office here in the city, but you'd like to be able to talk to your home in Somerville.

EMERY

That's right, Mr. Hubbard.

HUBBARD

You know about setting your own poles and stringing your wire—

"One moment, that sound . . ." Raymond Edward Johnson, who played the role of Bell, demonstrates to an NBC sound-effects man the twang of the vibrating reed on a model of Bell's experimental apparatus

EMERY

Guess I do. Got a stretch of poplars along the road part way. Would they do for poles?

HUBBARD

They'll do fine.

EMERY

Not so sure about stringing the wire, though.

HUBBARD

Well now, we can get it done for you, at five dollars a mile. Not counting the price of wire, that is . . . You'll need some insulators, too. Cost twenty-five cents each. After all that's set up, we leave you two telephones, price forty dollars a year, payable semi-annually in advance. We keep the line in repair free of charge.

EMERY

Meant to ask . . . Need any trainin' to run the thing?

HUBBARD

Not a bit! Nothing complicated. Just a place to listen out of, and a place to talk into. We'll do the rest.

(MUSIC UNDER)

NARRATOR

By August 1877, sixteen months after the first transmission of the human voice over wire, there were

Other members of the cast find something amusing as they rehearse their parts

Among the principals in the Bell Centennial Telephone Hour broadcast were (l. to r.): Raymond Massey, the narrator; President Walter S. Gifford of A. T. & T.; Miss Helen Traubel, soprano; and Donald Voorhees, conductor of the Bell Telephone Orchestra and Chorus

778 telephones in use. A staggering figure for the time, you can be sure! There were still the doubters and scoffers, but some said the telephone thing was here to stay! And, in 1878, the first commercial telephone switchboard was put into operation in New Haven, Connecticut, with eight lines and twenty-one subscribers. But there were problems. Like the calling apparatus. Nothing like a bell at first. Someone just tapped a pencil on the diaphragm and if someone heard it at the other end, fine. If not, well, you'd keep on trying. Then there was a "buzzer" call.

(MUSIC OUT. SOUNDS OF WATSON'S BUZZER: MUCH LIKE AN OLD RAUCOUS AUTOMOBILE HORN)

Folks didn't like that too much, especially at night. Next came the bell model with the hand crank.

(SOUND OF HAND CRANK BELL)

In the early telephone exchanges, when you'd put in a call, there was no charming young lady operator at the other end, but . . .

OPERATOR 1 (BOY)

What do *you* want!

(PLAYFUL MUSIC CHORD)

NARRATOR

Or, a bit more conversationally—

OPERATOR 2 (BOY)

Rudley Leather Shop? Line is busy. I said the line is busy. What's that? You don't believe me? Now that's too bad. Stick your head in a tar barrel.

(MUSIC: CHORD)

NARRATOR

Or, in the midst of a conversation, the boy operator at the exchange would cheerfully cut in . . .

OPERATOR 1 (BOY)

You still talking? Why don't you get off and take a deep breath? Ha, ha, ha . . .

(LAUGHTER BEHIND. MUSIC: OVER AND OUT)

OPERATOR (GIRL)

This is Central. 426? Thank you. I'll ring them for you.

NARRATOR

Yes, it wasn't long before the voice with a smile greeted the subscriber, and with it a new era of expanded service. "I believe," said Alexander Graham Bell in 1878, "that in the future wires will unite different cities, and a man in one part of the country may communicate by word of mouth with another in a distant place." And slowly it came to pass.

OPERATOR VOICES

This is Boston.
Hello Salem.
Hello Providence.
This is Detroit.
Hello New York.
Hello Chicago.
(FADING) Hello. Hello. Hello . . .

(MUSIC UNDER)

NARRATOR

The century turning, bringing new cities, and the thunder of industry. The spaces of the West being filled, the endless footsteps of migration, opening of new vistas; the railroads branch out, the roads breaking forest and desert; everywhere the tireless heart of America stirs with the energy of many peoples. And everywhere the telephone lines go forward.

OPERATOR VOICES

Hello St. Louis.
New Orleans calling Cleveland.
Hello Dallas. Hello Denver.
(FADING) Hello. Hello. Hello . . .

NARRATOR

Wires humming between cities. The switchboards grow from a few circuits to hundreds, thousands . . . Until one day a ceremony is performed. It is January 25, 1915. Seated at a long desk, the now gray-haired Alexander Graham Bell, with a wisp of a smile—remembering the early struggles perhaps?—picks up his telephone in New York City.

(MUSIC OUT)

BELL

Ready, gentlemen?

VOICE 1

In a moment, sir.

VOICE 2

Will they hear you in San Francisco, Mr. Bell?

BELL

I believe so.

VOICE 2

But still, it's over 3,000 miles . . .

Jascha Heifetz, violinist, was a featured soloist

BELL

It can be three million. As long as the poles are standing, and the wires drawn, and the human voice can speak, why then it shall be heard.

ENGINEER

Circuit open, Mr. Bell. Go ahead.

BELL

Hello, San Francisco. (PAUSE) Mr. Watson, come here, I want you!

WATSON (FILTER)

Mr. Bell, I would be glad to oblige, but it would take at least a week.

(LIGHT LAUGHTER—MURMUR OF VOICES BEHIND)

BELL

How's your voice today, Mr. Watson?

WATSON

Pretty good.

BELL

Let's hear you sing a little song for my friends. Come on, you've done it before . . . How about "Auld Lang Syne"?

WATSON

I'll try.

(BEGINS TO SING. MUSIC TAKES THEME OVER AND DOWN BEHIND)

NARRATOR

The future throws its giant shadow; radio-telephone:
The human voice lifts across the Atlantic,
From land to sea to land—encircles the globe,
And the drama is brotherhood, man's joining.
The sound of guns, names of the past break in,
Chateau-Thierry and Belleau Woods and Soissons;
And the newer names: Guadalcanal, Tarawa, Anzio,
Utah Beach, Normandy . . . and the guns become quiet.
Again the wires and lines connecting, joining,
Binding the space between the broken cities,
Man calling man to the arts of labor and construction.
The hundred-voiced switchboards of the large cities,
The single voice of the village, each holding open
The tens of million miles of wire, touching
Homes and rooms and desks and the roaring traffic.
The speech of a nation, voices of the big and little,
The family of peoples in a house of many states,
Instantly touching . . . while men in the laboratories
Bring the cosmic secrets, large as the hemispheres,
Into the hand of man. And mighty are its wonders:
Mobile telephones, the coaxial cable to carry the flow
Of five hundred separate voices, television, radar, sonar . . .
The search goes on, begun from the tremor of a voice.
Where will it end? It does not end. It begins always.

(MUSIC: UP AND OUT. APPLAUSE)

The Pioneers and the First Pioneer

THE Telephone Pioneers of America have long esteemed Alexander Graham Bell as first among the Pioneers, and Pioneer groups from coast to coast in this country and in Canada met to observe the centenary of his birth. More than 250 gatherings of chapters and councils and clubs, numbering from fewer than 50 to more than 2,000 in attendance, held luncheons, dinners, or evening assemblies on March 3.

Dinners and evening meals made a point of hearing the Telephone Hour, or in some instances just the address of A. T. & T. President Walter S. Gifford which was its climax. Usually the program was piped in by direct wire from the nearest NBC outlet. Many of the groups were able to view a premiere of "Mr. Bell," the A. T. & T. centennial motion picture long in the making, to help commemorate the day. Special courtesies were paid to Life Member Pioneers at many gatherings, and program committees everywhere provided a variety of appropriate entertainment.

Addresses eulogizing Dr. Bell were the order of the day or evening, of course. Some were made by com-

Many groups of Pioneers met to do honor to Alexander Graham Bell on March 3. For the newly-formed Stanley S. Holmes chapter it was the first meeting, and acceptance of the charter was one of the events of the program

The President of the Board of Education of Washington, D. C. (left) and the President of Alexander Graham Bell Chapter of the Pioneers unveil a plaque on the wall of a school

pany officers, some by Pioneer officers. Where, in the territory of some companies, several gatherings were linked together by direct wire circuits, one man could speak to many. Somewhere else, a toastmaster might call on more than one man to address a few.

Whatever the time, the place, the form of the gathering, the theme was common to all: to do honor, in good fellowship, to one man—Mr. Bell.

The Heritage of the Pioneers

From the remarks of Mr. J. E. Harrell, President of the New England Telephone and Telegraph Company, to groups of Pioneer Life Members meeting in 13 cities on March 3:

"With a generous nature, it was ever his desire and pleasure to serve his fellow men; to treat them with kindliness and consideration. Wherever human welfare was concerned, his heart as well as his mind went into the work at hand. Particularly did he find great joy in his lifelong work to lighten the burden of the deaf. You will recall that it was as a teacher of the deaf, that he first came to

Boston. In later life, he was their benefactor in founding and supporting organizations for their welfare. We who carry on the telephone business today hold dearly all that Alexander Graham Bell was and did. The desire to serve others, the urge always to pioneer, the telephone itself,—all these make up our inheritance from him. It is a heritage which you life members in the Telephone Pioneers received from the Pioneers who preceded you and which you faithfully passed on to us who are still active in telephone work. We in our turn will hand it on to those coming after us. This living chain—to guarantee continued progress in the telephone art—will perpetuate the unique bequest made to the world by Alexander Graham Bell who was born 100 years ago today."

The Span of a Single Lifetime

From the remarks of Mr. T. N. Lacy, President of the Michigan Bell Telephone Company, to 19 group meetings of Telephone Pioneers on March 3:

"From the first, Bell visualized his invention as an instrumentality of public service. He foresaw homes linked with offices, physicians quickly put in touch with their patients, the isolation of farms swept aside, and cities linked together with bonds of speech.

"Those ideas and ideals were Dr. Bell's contributions to the science of communication, and to the world. He predicted that nationwide telephone service could be developed, but he also realized that he alone could not do it. It remained for his successors to transform his hopes into realities, and that task ultimately required the minds, the hands, and the financial backing of literally millions of people. . . .

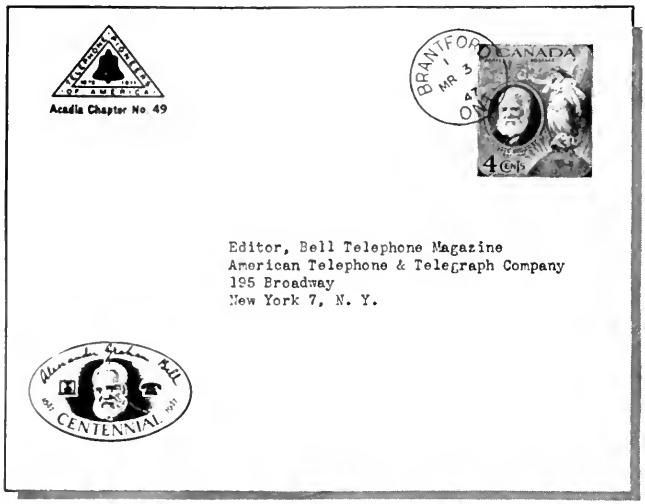
"If Dr. Bell could be here tonight, I am sure that he would want to express his appreciation of all that his successors have done to make his invention the important part of modern business and social life that it is today. On many occasions he *did* voice his pride—and his wonder—at the expansion and improvement of telephone service within *his* lifetime. And in 1922, shortly before his death, Alexander Graham Bell said: 'The telephone has gone all over the world since 1876. It has grown far beyond my knowledge. The telephone system as we know it today is the product of many, many minds, to whom honor should also be given. . . .' "

Teacher and Humanitarian

From the remarks of Mr. R. C. Verity, General Plant Manager, Chicago Area, Illinois Bell Telephone Company, to a luncheon of Life Members of the Pioneers in Chicago on March 3:

"In the years that have passed since the invention of the telephone, Bell's contributions to other fields have become obscured. The great passion of Bell's life was his work with the deaf. With the same enthusiasm that he displayed in everything that he did, he fought for decent education for the deaf, who, until his time, were often treated as though mentally deficient. . . .

"In 1878, Bell began an elaborate investigation into the cause of congenital deafness. For many years, he had been aware that many deaf children came from families in which deafness from birth had occurred again and again. For four years he collected information about families in which deafness appeared. In 1883, he published his findings. In his report, he indicated that those who forced the deaf to turn to each other for companionship were doing double damage—for when deaf people married, deaf children were frequently the result. His studies attracted international attention once more, and in 1900 he was appointed special agent of the United States government to take a Census of the deaf. . . .



The Canadian Post Office issued a Bell Centennial postage stamp, and many first-day covers were canceled at Brantford, location of the Bell family home in Canada

"The direction of his interests is clearly indicated by the number of his published lectures. While he published 22 speeches and papers on the telephone and the photophone (which was, incidentally, the forerunner of the infra-red telephone), he published 73 papers and lectures on subjects related to deafness, teaching the deaf to speak, surgery and eugenics. . . .

"Let us remember him today—not only as the inventor of the telephone, which was in itself one of the most humanitarian of all inventions—but, as he wished to be remembered: . . . a teacher of the deaf—devoted to lightening their burden. For it was as a teacher, as a humanitarian, that Alexander Graham Bell fulfilled his destiny."

Two Kinds of Pioneering

From the remarks of President Floyd P. Ogden of the Mountain States Telephone and Telegraph Company to a meeting of Telephone Pioneers in Denver on March 3:

"Tonight we celebrate the hundredth anniversary of the birth of the first telephone pioneer—Alexander Graham Bell. He was as truly a pioneer in the realm of science as the hardy trappers and explorers were in their field as they pushed the frontiers of civilization westward further into the wilderness.

"It is interesting to realize that at the time of Bell's birth, although parties of white trappers and explorers sometimes camped at the junction of Cherry Creek and the Platte, there was no permanent settlement where Denver now is; in fact, the sway of the Indian was still unchallenged. However, the route of the 'Trappers' Trail' between Taos, New Mexico, and Fort Laramie, Wyoming, passed over what is now the site of Denver. Mounted riders frequently carried messages between these two points. . . .

"To indicate to you the difficulties ahead of the telephone pioneers at that time, I need only remind you that twenty-four years later—at the turn of the century—there were only 1,322,000 telephones in the country, 1.7 telephones per hundred population. Today there are 32,000,000 in the United States: 21.8 per hundred population.

"We telephone people celebrate the centennial of Bell's birth not alone because his adventures in pure science made possible the world-wide service of communications we are privileged to render, but because he was a great humanitarian, a great benefactor to mankind, especially to the handicapped."

The Bell Centennial in the Press

THE CENTENNIAL *of Dr. Bell's birth was widely recognized, and newspapers throughout North America noted the day and its significance. Of their many comments, some few may be quoted in part:*

"Wonders of Wonders," the New York *Times* heads its editorial about Dr. Bell, and concludes it in this fashion:

"The telephone outgrew Bell just as the electric lamp outgrew Edison. Long distance communication was beyond Bell. It demanded research of the highest order in physics, chemistry, metallurgy, engineering, magnetism, the mechanics of speech. So huge was the task that an industrial laboratory had to be organized, and out of the industrial laboratory that dealt with the transmission and reception of speech came scores of inventions that led to transatlantic radio and to television.

"It is always thus. An invention is not a terminal, but an avenue which is traveled by great technologists who behold ever more magnificent vistas as they progress. Lord Kelvin, while he was still Sir William Thomson, must have beheld some of these vistas in his mind's eye. 'Wonder of Wonders' he called the telephone. That the human voice should be carried to the uttermost ends of the earth still astonishes. If in the middle of the last century our fathers had read to their children a tale about a charming princess who summoned an equally charming prince to her rescue over a copper wire with the aid of some wonderful lamps in which magical filaments glowed, there would have been cries of admiration. Well, fairy tales have a way of coming true in science and invention. And Bell's telephone is one of them."

The New York *Sun* distinguishes —as has many an anxious individual —between the monetary value of a telephone and its intangible worth to human-kind:

"Now there are 51,500,000 telephones in the world, 32,000,000 of them in the United States. In New York city alone there are 2,218,000 of them, 928,000 more than there are in all of South America. Today sixty countries and territories are linked by radio telephone and the development of the mobile telephone has progressed so far that by the middle of this year half of the cities in the United States with more than 100,000 population, and 5,000 miles of the busiest highways, will be equipped for that type of service. It would be difficult indeed to compute the debt which the world owes to Alexander Graham Bell. He probably would not care as much about what it means in dollars as the lives it saves when help is needed quickly, the comfort it brings by dispelling loneliness in isolated spots, the friendships it strengthens by speeding social contacts. Granted enough data, statisticians could calculate what the telephone means in the dollars and cents of the business world. For the balance of the debt there is no human measure."

The Ocean Grove (N.J.) *Times* terms the Bell System a monument to the telephone's inventor:

"It can be truly said that the Bell System belongs to people in all walks of life, in the cities, towns and rural areas of America. Five states have more than 50,000 stockholders each, 26 states more than 5,000 and no state has fewer than 500 stockholders.

"The capital of the Bell System comes from the savings of the many rather than the wealth of the few. There could be no finer monument than this to the memory of Alexander Graham Bell, the inventor of

A "still" from the A. T. & T. Company's motion picture "Mr. Bell." Here he says good-bye to one of his deaf pupils after having taken refuge on the porch of a Boston hotel during a storm

the telephone, whose birth 100 years ago will be celebrated on March 3."

The Washington (D.C.) *Post* quite naturally feels a rather proprietary interest in the occasion:

"A century ago today Alexander Graham Bell was born in Edinburgh, Scotland, but it was only a little more than 70 years ago—that is to say, within the lives, if not the memories, of many persons still among us—that he gave the first successful public demonstration of his talking gadget at the Centennial Exposition in Philadelphia. This, as we now realize, was in invention comparable in its historical significance to the smelting of iron, or to first printing from movable types, or to the earliest utilization of steam power. Indeed, the telephone has become so much a necessity and so much a commonplace of our existences that it is difficult for us to remember that even less than two generations ago the great majority of civilized mankind managed to get on, after a fashion, without it. . .

"The Bell Centenary has, of course, a special interest for Washington, because it was here that Dr. Bell made his home throughout the greater part of his life. He was perhaps, until his death in 1922, the most famous of our nonpolitical residents. This is also the home of many of his numerous descendants, who now extend into the fourth generation. His local memory is very closely associated with the National Geographic Society, of which he was one of the founders and for a time president. The present head of the society is his son-in-law, Dr. Gilbert Grosvenor. Quite appropriately, the National Geographic Magazine has devoted the leading article of its current number to the latest marvels of the telephone laboratories."

Discussion of the life of Bell leads the editorial writer of the Anderson (Ind.) *Herald* into a discussion of the telephone's future:

"Each and every one of us who own stock in the company, who are employed by it, who use the telephone in our daily life, must realize that the Bell Telephone Company is not a closed corporation, a giant monopoly, but part of the nation itself. This is the democratic pattern. It is a part of the framework of our nation and in so much as it has contributed to the American way of life, it is good.

"But even as men and women are honoring the birth of the inventor, they are looking to new horizons. These inventors, research scientists, linesmen, operators, administrators, subscribers know that the future is bright and new vistas are to be opened by this invention and the children of this invention. The company could never have became a part and parcel of everyone's daily life save in a democracy. And the democracy could never have been what it is today without the telephone."

A small part of a long "column" in the St. Joseph (Mo.) *News-Press:*

". . . You will read and you will hear of this amazing man, born in Scotland, educated in Scotland, Germany and America. His life was a life of devotion to a cause, not devotion to money or fame. He devoted his life and labor to inventive study as St. Francis Xavier devoted his life to missionary zeal or David Livingstone gave his to African explorations and Admiral Byrd is giving his to polar explorations. . ."

"Scientific progress knows no national, no racial barrier. This is the centennial year of two towering geniuses, Edison the American born, Bell the Scotch born. Invention and discovery know no narrow boundaries from Galileo the Italian to Daguerre the Frenchman to our own Americans from Franklin down through Whitney and Fulton and Morse and McCormick, Westinghouse and Goodyear and the Wrights. And it is true even to the youths working today in oblivion in the laboratories of our great corporations. These yet to achieve fame are sinew of that intangible, invisible something that is the soul of America, the peerless. Lives of men such as Alexander Graham Bell are their eternal beacons, leading them ever onward."

How the soil of free enterprise nurtured the growth of the telephone is the theme of—among others—the San Marino (Cal.) *Tribune:*

"It was in America, the land of free enterprise, that the telephone was born and grew up. It was while Dr. Bell, in the footsteps of his father and grandfather, was helping afflicted people to live happier lives, by teaching deaf children, and adults too, how to speak, through a system of 'visible speech,' that the idea, the vision, of the telephone first came to him. One more example of how American genius spreads itself world wide for betterment of all peoples; for the wires of the Bell System reach everywhere. . ."

"He Wasn't Afraid to Think," headlines the Portland (Ore.) *Oregon Journal:*

"The telephone brought him a fortune, but money for him was something to be used for others. He hastened the development of enlightened methods of education of the deaf, he supported aviation, he devised an electrical apparatus to locate bullets or other metals in the body, he described a device having the same purpose as today's iron lung, he directed experiments in breeding sheep. His mind pioneered. He didn't 'keep forever on the public road, going only where others have gone.' "

Where does this paragraph from the Toronto (Ont.) *Globe and Mail* leave telephone users south of the international border?

"The spread and development of Mr. Bell's invention moves even today at a pace that is astonishing. Telephones are everywhere: in ships and planes and trucks and trains, in automobiles, coal mines, sub-

Miss Joan Blair, great-granddaughter of the inventor of the telephone, wears a costume of the 1870s to pose with a model of her famous ancestor's first telephone

marines, and even in that last sanctuary of human privacy, the bathroom. We Canadians are prolific users of the machine, making three billion phone conversations through 1,700,000 telephones over 380,000 miles of wire every year, a record second only to that of the United States. One must conclude from this that either we are tremendously advanced culturally and scientifically in comparison with the rest of the world—or, which may be closer to the truth, we are disgracefully talkative."

The Windsor (Ont.) *Star* notes that while Bell was born in Scotland, Canada claims him as her own, and continues:

"There is, however, honor and to spare in this invention which has meant so much in the development of our civilization. It was brought forth on this continent by a great man, a product of the United Kingdom who owned both Canada and the United States as countries of his adoption. The Dominion can rightfully claim with pride a share in his momentous life work."

And *La Tribune* of Sherbrook (Que.) concludes a long and informative editorial:

"L'univers civilisé honore en ce jour la mémoire de ce genie prodigieux. Plus heureux que bien d'autres savants et inventeurs, Bell aura mis à point et perfectionné un instrument devenu d'usage indispensable et qui perpetue à chaque instant du jour le souvenir de son nom."

Helen Keller and Dr. Bell

The following is a stenographic transcript of part of a broadcast by George Carson Putnam over WOR *and the Mutual Broadcasting System on March 3:*

"Everybody knows the story of Helen Keller, the girl who lost her sight and hearing at the age of 19 months. Miss Keller is now 67 years of age. When she was seven, Anne Sullivan Macey went down to the little town in Alabama where Helen lived in a tight little world all of her own, unable to see, unable to hear, unable to talk—alive, but yet not really living. Anne Sullivan Macey was Helen Keller's teacher from 1887 until the day of her death in 1936.

"In that time, Helen Keller has won worldwide fame and has probably met more of the world's truly great than any other living person. Well, last Friday I telephoned Helen Keller's residence up in Westport, Connecticut. I talked with Polly Thompson, that wonderful Scottish lady who's been Miss Keller's constant companion for almost half her life . . . and she said they'd be glad to come to the studio and talk with me.

"Meeting Helen Keller is one of the greatest thrills I've ever experienced . . . and here's how we had our interview. Polly Thompson holds Helen Keller's right hand, and her quick fingers spell out each question by touch, and then the smiling Helen Keller raises her face and answers in a speech somewhat halting, but quite understandable as one becomes accustomed to it. Well, we discussed what we were going to say . . .

"To open the transcribed interview I turned to Polly and asked:

Transcription

"Miss Thompson, how long have you been a companion to Helen Keller?"

MISS THOMPSON: "Thirty-two years."

MR. PUTNAM: "I understand that Alexander Graham Bell was instrumental in aiding Miss Keller many years ago."

MISS THOMPSON: "Yes, he was, Mr. Putnam."

MR. PUTNAM: "Will you tell us about it, Miss Thompson?"

MISS THOMPSON: "Dr. Bell counseled Helen's father to write to the Perkins Institution for the Blind in Boston, asking if a teacher could be sent to her, and out of that suggestion came the light and the joy and accomplishments of Helen's life. Helen always called Dr. Bell her old friend. He often encouraged and advised Anne Sullivan Macey, Helen's teacher, in her work in teaching Helen to speak. What has endeared Dr. Bell most to Helen is the fact that his first wish while working on the telephone was to make the deaf hear, and Helen feels it would be a satisfaction to him on this anniversary if he could observe their ever increasing progress towards all-around education and normal living."

MR. PUTNAM: "Thank you very much, Miss Polly Thompson, companion to the famed Helen Keller, and thank you, Helen Keller, very much."

(*End of Transcription*)

"As we finished the interview, gracious Helen Keller rose and took my hand. 'Mr. Putnam,' she said, 'I'll long remember this day. You see, it has a double significance to me, for just 60 years ago this third of March, Anne Sullivan Macey traveled to the little town in Alabama where I was living, and took me under her wing. So, you see, it's a double celebration for me. The 100th birthday of Dr. Bell and the 60th anniversary of Anne Sullivan, who led me by the hand into a world I never knew.' "

President Harry B. Thayer

He was head of the American Telephone and Telegraph Company when the Bell Telephone Quarterly *was launched in April 1922*

The First Twenty-Five Years

"The administration of an institution like the Bell Telephone System, with its responsibility for a service entering into all of the ramifications of the domestic and commercial life of millions of users and with its responsibility to hundreds of thousands of stockholders and security holders, to work effectively, must be actuated by a continuous policy or motive and must make every line of action conform to a programme directed toward carrying through that policy. Changes in times and conditions may properly affect the programme but the underyling policy must be constant."

Those words are from the Annual Report of the American Telephone and Telegraph Company for the year 1922. Even a quarter of a century ago, they testify, the national obligations of the Bell System had long been accepted, its institutional character recognized, the direction of its over-all policy established.

As one more means for the furtherance of that policy, there was established in that year at A. T. & T. Headquarters a publication for the information of Bell System officers and executives. It was called the Bell Telephone Quarterly, and Volume I Number One bore the date of April 1922.

The present issue of its successor, the Bell Telephone Magazine, likewise appearing in April, is Volume XXVI Number One.

It marks twenty-five years of continuous publication.

At the beginning of 1922, there were, for instance, 13,380,000 Bell and connecting telephones in service, and 224,000 employees; the daily average of telephone conversations in that year was 38,350,000. At

JAMES D. ELLSWORTH

As publicity manager of the A. T. & T. Co. Information Department in the early 1920s, he was responsible for producing the QUARTERLY

the beginning of 1947 there were 31,600,000 Bell and connecting telephones, and 617,000 employees; and for the preceding year the daily average of telephone conversations was 105,762,000.

If twenty-five years have in their passing brought no such startling contrasts in this publication, they have seen some changes nonetheless.

Appearance has changed, naturally, in keeping with changing times. But more significant, we have tried to broaden the content of the publication as its readership has broadened. Although editorial progress is not necessarily obvious from one issue to the next, the growth of the past quarter-century is on record in the 25 volumes now completed.

THE NEW VOLUME is begun—the view is forward.

The MAGAZINE still aims—as its predecessor did twenty-five years ago—not to instruct but to inform. It hopes to leave to others those matters which are of necessity largely technical. It tries to be simple and clear—which in a complex business isn't always easy—and interesting. Within those ground rules, its field is as wide as the industry, and so is the opportunity.

"A young, active, and progressive institution," Mr. Thayer termed the Bell System of 1922. The QUARTERLY and the MAGAZINE have reported regularly many instances of its vitality in the twenty-five years since. Every issue of the publication has borne on its masthead the words "A Medium of Suggestion and a Record of Progress." The MAGAZINE intends to continue its function as a record of progress. May is serve also and increasingly as a medium of suggestion to the people of the Bell System as they carry on their work of national inportance!

THE EDITORS

Single Copy, 50c $1.50 per Year

BELL TELEPHONE QUARTERLY

APRIL, 1922

Contents

FOREWORD . . . . . *H. B. Thayer*
THE RADIO TELEPHONE SITUATION . . *A. H. Griswold*
THE WORK OF THE BELL TELEPHONE SECURITIES COMPANY . . . . . *D. F. Houston*
THE TELEPHONE'S DEVELOPMENT (AN ABSTRACT OF VERBAL TESTIMONY) . . *J. J. Carty*
SOME NOTES ON STATISTICS . . . . . *S. L. Andrew*
PROGRESS OF THE JOINT COMMITTEE ON RELATIONS OF SUPPLY AND SIGNAL CIRCUITS . . . . . *Bancroft Gherardi*
NOTES ON RECENT OCCURRENCES . . .
ORGANIZATION CHANGES . . . . . .

American Telephone and Telegraph Company
New York

The cover of the first issue, slightly reduced in size. The authors were all important figures in the A. T. & T. Company a quarter of a century ago

BELL TELEPHONE QUARTERLY

A MEDIUM OF SUGGESTION
AND A RECORD OF PROGRESS

Published quarterly for the Bell System by the American Telephone and Telegraph Company

Subscription, $1.50 per year, in United States and Canada; single copies, 50 cents

Address all communications to
INFORMATION DEPARTMENT
AMERICAN TELEPHONE AND TELEGRAPH COMPANY
195 Broadway, New York

Vol. I APRIL, 1922 No. 1

Foreword

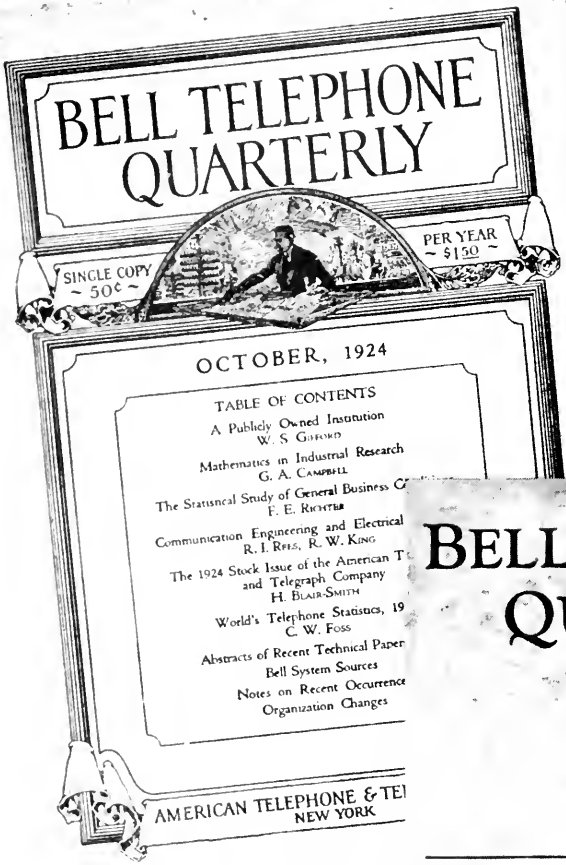
BEING a young, active and progressive institution, the Bell Telephone System is continually doing new things, sometimes in service to the public, sometimes in operating technique, sometimes in commercial policy. The new thing may be done in any part of the country. These new things are interesting to telephone men in other parts of the country. If they are experiments in service or technique and are successful, they ultimately become generally known by being standardized and covered by specifications and described in bulletins. There are some even more important innovations, interesting even in the nebulous state and more so as they become accomplished facts, which the presidents and general officers would like to observe during the experimental period. I refer to the type of things which we have usually discussed in conferences of presidents and general managers. As a medium of suggestion, a report of progress and perhaps an announcement of results on matters of that type between conferences, we launch with this number the BELL TELEPHONE QUARTERLY.

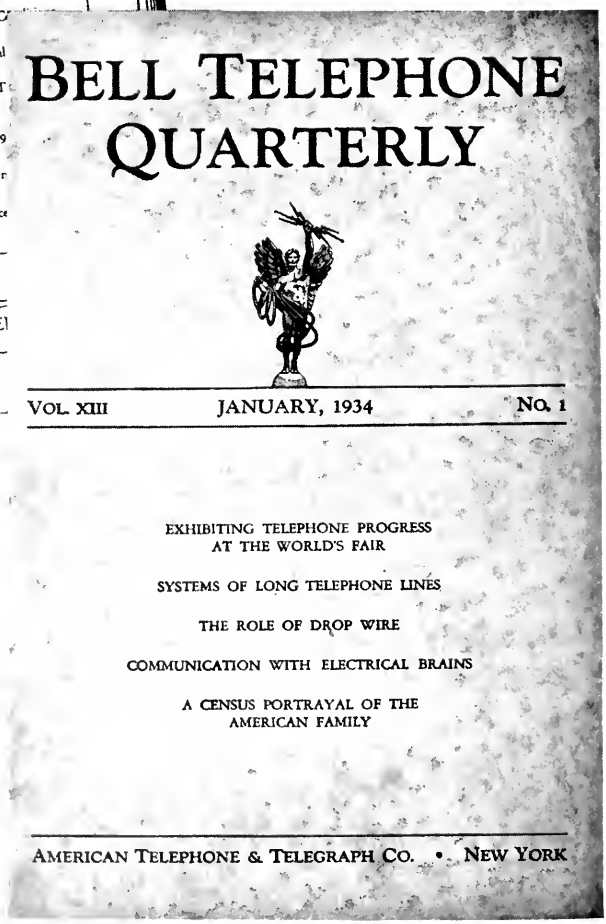
H. B. THAYER.

[1]

President Thayer describes the ways in which the QUARTERLY *plans to serve the Bell System. The page size was slightly larger than the dimensions of the present page*

The cover design at the left served for 10 years, and that below until the present design was adopted in 1943. Dark blue ink on a lighter blue cover stock was standard for nearly 20 years





QUARTERLY became MAGAZINE in 1941, without other change in the cover's general appearance. The nominal charge was discontinued in 1939.

The Extension of Bell System Overseas Telephone Service "With the Rest of the Known World" Has Now Conquered The Frontiers of Distance

America Is Calling

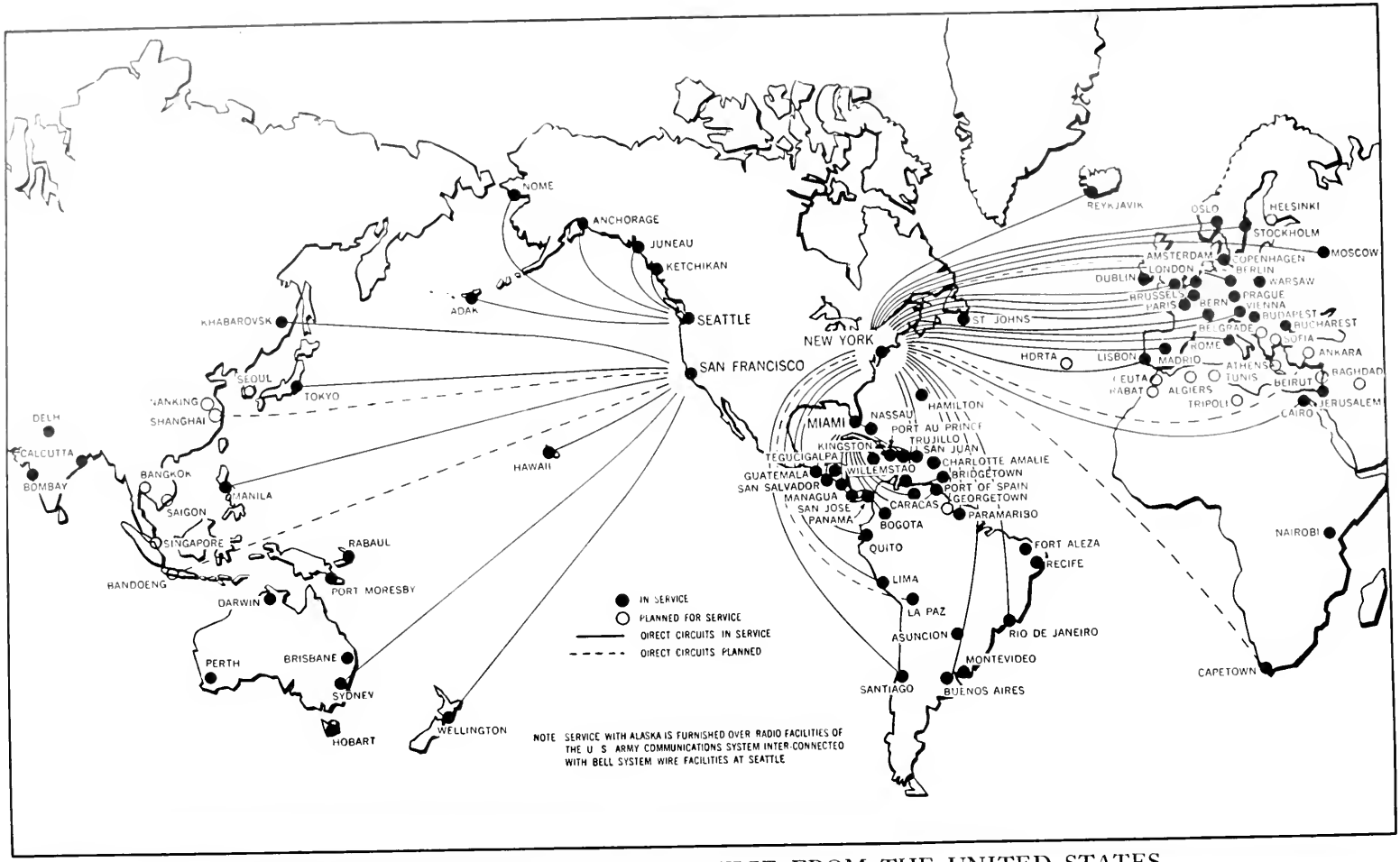
William G. Thompson

EVERY DAY, in this fast-moving world, a British solicitor, a French modiste, an Argentine rancher, a New Zealand wool broker, an Egyptian tobacco grower, a Russian opera singer, or their compatriots may answer the ring of the telephone to hear, in their respective languages, an operator say "America is calling." For the range of the telephone now spans the world. Speech has conquered the frontiers of distance.

As Bell System overseas telephone service observes its twentieth anniversary this year, it is interesting to look back to the original Certificate of Incorporation of the American Telephone and Telegraph Company, executed in 1885—for it contains a remarkable prophecy. Less than 10 years after the invention of the telephone, the founding fathers of the Bell System stated in that document their intention to interconnect all places in the United States, by cable and other appropriate means . . . "and *with the rest of the known world.*" At a time when the farthest stretch of the voice by wire was from New York to Boston, such a forecast had in it the pioneering spirit of America.

By 1892, only seven years later, long distance lines had reached westward to Chicago. Such were the technical difficulties encountered beyond that distance, however, that it was not until 1915 that the vacuum-tube amplifier, developed into a telephone repeater, finally made conversation possible between New York and San Francisco. Then was made practicable the fulfillment of that prophecy of a telephone system linking people throughout the United States; then the oceans bounding our nation became the new speech frontiers.

The next stage in telephone expansion began that same year, 1915. Successful experiments by radio were conducted between Arlington, Virginia, and Paris, France, transmitting one-way speech across the ocean for the first time. Further developments in the field of the vacuum tube had



OVERSEAS RADIO TELEPHONE SERVICE FROM THE UNITED STATES

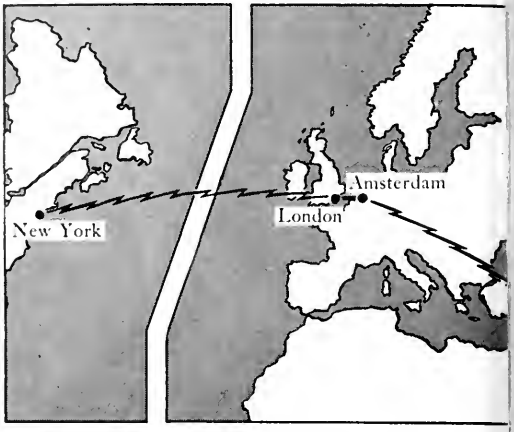
given telephony a new weapon to conquer distance.

A decade later, transoceanic radio telephony was ready for public use, and Bell System overseas telephone service was inaugurated on January 7, 1927. On that significant day Walter S. Gifford, President of the A. T. and T. Company, made the first overseas call to Sir G. Evelyn Murray, Secretary of the General Post Office in Great Britain, over the initial New York-London radio telephone circuit. Telephony had reached its first overseas beachhead on its world-wide advance.

After the official New York-London opening, the overseas service truly began its global march. Within eight years this expansion was dramatically demonstrated when, on April 25, 1935, Mr. Gifford again made an overseas call, but this time to Theodore G. Miller, then Vice President in charge of the Long Lines Department, who was in an adjoining room at long distance headquarters in New York. They spoke with each other over a circuit which encircled the world—starting in New York, reaching London by radio, next going via submarine cable and land lines to

The first circuit to London was by "long wave," utilizing a frequency of 60 kilocycles and transmitters of 200 kilowatts. This tremendous power was poured into an enormous antenna system one and one-half miles long, mounted on six steel towers which rose 420 feet above the Long Island countryside. The signal from England was received on a 3-mile-long antenna in the wilds of Maine, where electrical interference was at a minimum. Signals were amplified there and then sent by special circuits to New York. This long-wave equipment is still available, used principally as a stand-by, being placed in active service only when the short-wave circuits are inoperative.

The opening of commercial radio telephone service, January 7, 1927. This historic photograph shows A. T. & T. President Walter S. Gifford speaking to London while company officials listen



A dozen years ago Mr. Gifford (left) talked with the late Theodore G. Miller, then Vice President in charge of the Long Lines Department, who was in an adjoining office, over a circuit encircling the globe

Amsterdam, thence by radio to Bandoeng, Java, traveling over another radio link from there to San Francisco, and finally, by wire line across the continent, back to New York. A 23,000-mile call!

Encircling the World

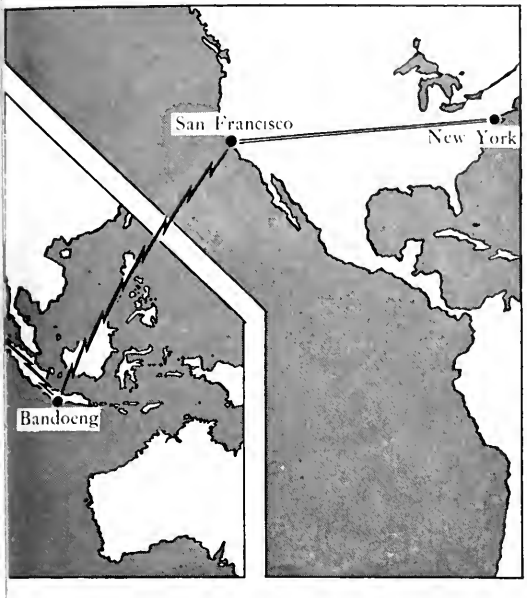
HERE is a brief sketch of the steps taken in building up the world-encircling telephone network which made that unprecedented call possible.

Within a short time after the 1927 opening, the English Channel was crossed and most of western Europe was joined to the transatlantic circuit by existing wire-line connections from London. In the next few years all of the major countries of Europe and North America were interconnected for telephone service.

The next approach to the goal of world-wide service was toward the south. In 1930, the initial circuit with South America was established between New York and Buenos Aires, Argentina. This was followed by circuits with Brazil and Peru, and connections with Chile, Paraguay, and Uruguay through Buenos Aires.

Westward, the course of overseas telephone service took its way across the Pacific. In 1931, short-wave radio stations with a radio telephone terminal at San Francisco were erected to serve countries in the Pacific and Far East. A circuit between San Francisco and Honolulu, T. H., became the first stepping stone across the Pacific. The further extension of service across that ocean reads almost like the voyage of Magellan: Manila, the Philippines, Tokyo, Bandoeng. Continuing its advance, overseas service reached Shanghai, China, in 1937, and Sydney, Australia, by direct circuit in 1938.

A third overseas radio telephone terminal, designed to serve Central America and the Caribbean, was established at Miami in 1932. The



Bahama Islands were the first territory to be connected with this terminal, followed in the next few years by Venezuela, Colombia, the Central American countries, Puerto Rico, and many others places in the West Indies. By 1939, most of Central and South America and many of the islands of the Caribbean were linked to this country by voice channels.

In addition to the service with Europe, the Americas, and Pacific territories, connections with North and South Africa, the Near East, Iceland and India were available via Europe.

The Change from Long to Short Waves

OVERSEAS SERVICE was initiated with long wave equipment; but the engineers recognized that such mammoth systems did not lend themselves to economical or widespread service. Nor was there sufficient frequency space in that part of the spectrum available to accommodate more than a few such circuits. Accordingly, the development of short waves between 4 and 20 megacycles was promptly undertaken; and in June, 1928, the first commercial short-wave circuit was set up between New York and London. Its performance was such that two more short-wave circuits were soon introduced, and from that time on all new systems installed have been short wave.

Although a great improvement over the long wave, these original short-wave systems still required extensive and expensive antennas mounted on high steel towers. With this problem in mind, the engineers next developed a "rhombic" antenna, the type currently in use on most circuits today. Relatively simple and inexpensive, these antennas can be erected quickly and do not require too much space.

The most significant development in overseas service to occur in recent years is the adaptation of the single-

sideband method of transmission to short-wave telephony. This method has two advantages over conventional double-sideband transmission. First, it is more efficient, so efficient, in fact, that it uses only about one-tenth the power required by double sideband. A second and more important advantage is that with a single-sideband system it is possible to carry two or three conversations on the same radio system simultaneously.

The short-wave frequency spectrum is a very congested medium, since it must carry the long distance radio communications of the entire world. One of the biggest problems in radio operation is the allocation of the frequencies needed for all services so that each may operate without interference with the others. Not only must provision be made for telephone services but also for telegraph services, broadcasting, services to ships at sea, to aircraft, to the military, and many other services. Single sideband transmission contributes to the efficient use of frequency space, and without this system the growth of radio telephone service to meet the post-war needs of the telephone user would necessarily have been limited. The shortage of frequencies still remains the principal difficulty to be overcome in the expansion of overseas radio telephony.

Still another development in overseas service involved the establishment of direct circuits. As the growing network fanned out and traffic increased with the European continent, it became desirable to provide direct circuits to the countries originally connected through London. By 1936, the New York-London group had grown to four circuits (short wave) and one standby circuit (long wave). Late in that year a single circuit was set up between New York and Paris, with an alternative route provided over the New York-London group. Plans were then worked out to establish direct circuits with Berne, Berlin, and Rome in 1939. In the midst of preparations to test the New York-Rome circuit, and with the requisite radio equipment on the high seas enroute to Berne, war came upon Europe.

Storm over Europe

THE STORM brewing over Europe broke suddenly upon the world on September 3, 1939. Though the climax came suddenly, there had been indications through overseas telephone service contacts that all was not well. During the progress of negotiations in 1938, Swiss telephone officials hinted that "Der Tag" was imminent. By the spring of 1939, they were pressing vigorously to secure direct circuit equipment to keep from becoming isolated telephonically when war came. Although not fully recognized at the time, another significant portent was the determined efforts of the Italians to place the new Rome-New York direct circuit in service during that summer, although it was not scheduled until the fall of 1939.

In the last days of August of that year, the military commands in Great Britain and France restricted to government traffic the use of overseas circuits to and passing through those countries. This cut off the European continent from telephone contact with the United States.

But not for long! Fortunately, the New York-Rome circuit was nearly ready for service. Tests were rushed, and service was opened to Italy on

A general view of the new overseas operating room at Long Lines headquarters in New York, with positions for 85 operators. Here are handled calls to Europe, South America, the Near East, and to ships on the Atlantic

September 11. Within a few days, arrangements which would ordinarily require several month of negotiations were made to reach the remainder of Europe over landline circuits to Rome.

In the meantime, further routes were sought. It was known that the Dutch were well advanced in the field of overseas radio telephony and that they had considerable radio plant in use between the Netherlands and the Dutch East Indies. The possibility of a connection with the Netherlands was thereupon explored. The Dutch were most coöperative, and within a few days of the first negotiations a New York-Amsterdam circuit was established, following by only a day or so the setting up of the Rome circuit. At New York, it utilized facilities formerly used to London, and, in Holland, facilities normally used with Java. Thus, within a few days, service with Europe outside of Great Britain and France was again available for the public.

Incidentally, in the rush of getting two strange radio stations started, one of the Bell System radio engineers had great difficulty in trying to understand, over the circuit, the differences in equipment and operation at New York and Amsterdam. Suddenly he recalled that recent engineering publications had descriptions of both the Netherlands and the New York overseas systems, and he asked if Amsterdam had them. Sure enough, they did, and the material provided the means of opening the service in a matter of hours instead of weeks.

With the Italian and Dutch circuits available, traffic was divided. The Amsterdam circuit carried messages to the Low Countries and Northern Europe, while the Rome circuit carried them to Central and Southern Europe. The total volume

of transatlantic traffic was of course below its normal level, because of the loss of most of the calls to France and England. However, with war at their doorsteps, traffic to the other countries increased greatly.

This situation continued during the fall and winter of 1939. In the spring of 1940, with the invasion of Denmark and Norway, service to those countries was lost.

Later, with the occupation of the Netherlands and Belgium, the Amsterdam circuit was closed down as the Germans entered the city. Signing off, the Dutch told the New York radio terminal staff good-bye, sent their thanks for their coöperation, and asked that their regards be forwarded to South American radiotelephone stations with which they also had been working.

The invasion of France followed swiftly, and the Paris radio telephone station closed down on June 10, when the Germans were a few miles off. Shortly afterward, Paris fell.

Once more, transatlantic service was dependent upon the single New York-Rome circuit for all traffic with the European continent.

New Circuits into Europe

All during these months, the Western Electric Company had been trying desperately to complete certain radio telephone equipment for the Swiss, so that a New York-Berne circuit could be established. From the start, the Swiss station near Berne had seemed doomed to misfortune. Built prior to the summer of 1939, it had been destroyed by fire before it was finally completed. It had then been rebuilt and a high-power transmitter installed; but the new single sideband equipment was being built by Western Electric in this country.

The Germans, although at war, went ahead with plans to build all their own equipment, and in the late spring they advised that they were ready. It so happened —and of course no one knows just quite how—that the tests on the German circuit did not reach a satisfactory conclusion until the Swiss circuit was completed. By a strange coincidence too, the circuits were ready at the same time—and so the circuit to Switzerland and the circuit to Germany were opened on the same day: July 10, 1940.

It was a race against time, since there did not appear to be any way to get this equipment to Switzerland if Italy entered the war. Luckily, it was decided to send parts as completed, and the receiver was shipped early in May, in time to arrive safely in Switzerland. Late in May the transmitter and control equipment were completed. However, through delay in obtaining a British navicert and the insistence of the Swiss that they be shipped on an American liner, the equipment started for Geneva on a vessel which turned around in mid-ocean and returned to this country when Italy declared war.

The Swiss are experts in the art of telephony, although they were then not experienced in radio telephony. With necessity as the spur, they set to work and rigged up a control terminal from spare telephone plant. It was arranged that they use their double-sideband transmitter to talk with New York. Receiving from New York, they utilized the single-sideband receiver already delivered

A close-up of a switchboard position in the new overseas operating room

and installed. This established a test circuit over which American and Swiss engineers discussed means of using spare material from the Swiss wire telephone plant to build the privacy equipment. By the middle of July, 1940, a New York-Berne circuit was ready—and proved an invaluable link throughout the war.

In the fall of 1940, a New York-Madrid circuit was set up by utilizing radio telephone plant near Madrid which had been used for service with South America prior to the Spanish civil war. When Madrid was about ready, it was discovered that its station was shy an important but, fortunately, not bulky item of apparatus some fifty pounds in weight. None was available in Spain, but one was taken out of a radio station here. Handled as baggage, it accompanied an obliging passenger on the Pan American Clipper.

Leaving on Thursday, on Friday it was in Lisbon, where it was met by a special truck and rushed toward Madrid to be installed the next day. But Saturday night came with no word, and the Spanish force sat up all night waiting to install it. For, after flying across an ocean and dashing through Portugal and Spain, the all-important item was lost for twelve hours in the suburbs of Madrid, since the driver couldn't find his way in the dark. When he was located, the tired engineers went to work, and soon the equipment was installed and working. It continued to function until recently, when it was replaced by new single-sideband equipment.

Meanwhile, overseas service to the Pacific and Latin America continued to grow, unhampered by the war in Europe. Until the fateful 7th of December, the year 1941 looked like a quiet period for overseas. But as the news of Pearl Harbor spread, the circuits to and from Honolulu were swamped with a backlog of thousands of calls. Upon the declaration of war the Berlin circuit was cut immediately. However, at the request of the State Department, the Tokyo circuit was kept up some hours longer, for additional calls with Ambassador Grew.

As the Japs invaded the Philip-

The overseas radio telephone circuit control room in the Long Lines building in New York

pines and drew nearer and nearer to Manila, the telephone people there continued to operate the circuit with a quiet courage never to be forgotten. One day a calm voice asked for instructions as how best to destroy the radio telephone equipment at the very last minute. It added that if Manila did not answer on schedule very soon it would signify they were dead, prisoners or on Bataan. The speaker, then general manager of the telephone company in the Philippines, did escape to Bataan, and managed to get away at the very end. But two years later, while serving on General MacArthur's staff, he was killed in a plane crash.

With the fall of Manila came the loss of the circuit to the Philippines. A few months later, as the Japs drove south, the circuit with Bandoeng, Java, went down, the Dutch keeping it going until, at the very last minute, they destroyed their stations.

By early 1942, while service to South America and the Caribbean continued, public service to Europe was confined to Switzerland, Spain, and Portugal. In the Pacific, Hawaii alone remained connected. Circuits with London and Sydney were continued, but for government calls only.

Multi-channel Teletypewriter for the Army

As a result of the discontinuance of public telephone service to countries at war, there were available a number of facilities on both coasts which were put to good use for Army operations, starting in July, 1942. They were converted into multi-channel teletypewriter circuits, and in the United States, became the backbone of the Army's Command and Administrative Network which carried the great bulk of war traffic between

this country and the widely scattered Theatres of Operation overseas.* Many of the transmitters now handling traffic for the public are honorably discharged veterans.

During World War II, the broadcasters of overseas news became daily users of Bell System overseas circuits. To be sure, news programs from abroad were broadcast to this country on overseas circuits in the pre-war years, but such usage was reserved for special events of unusual interest. However, in wartime, programs from London and other foreign points were heard several times a day, and many of them came over radio telephone circuits. Likewise, the Office of War Information here used such circuits several hours each day to transmit programs to Europe.

D–Day was a proud occasion for overseas telephone service. Over one of its circuits, operated jointly with the Army, came the first word to the War Department that the invasion had started, as well as the first accounts of the landings to the broadcasting networks and news agencies. The supervisor in the overseas control office at New York was one of the few "alerted" to expect the great news, and he was the first person in America to know, early that June morning, that the victory march had begun.

Service for the Men Abroad

EVEN BEFORE D–Day, the Bell System had plans under way to restore pre-war overseas service to war-devastated areas and to strengthen the whole overseas network for the post-war needs of the public. In coöperation with the Army, one of the early objectives was the speedy establishment of telephone facilities to enable thousands of men in the Armed Forces abroad to call home. Further, international trade throughout the world, struggling toward revival and looking to the United States for vitally needed supplies, would be in urgent need of communications.

Soon after the landings on the Continent were made, a representative of the overseas service visited London, Rome, Paris, and Brussels to work out plans with the telephone people of the allied countries for the resumption of radio telephone services. At this time many of the governments with which plans were discussed were still in exile. In fact, Norway and later the Philippines actually ordered equipment before their countries were liberated. As soon as the enemy had been driven from their cities, France, Belgium, the Netherlands, and Denmark also arranged for new circuits.

The tale of the Norway negotiations gives a "behind-the-scene" glimpse of the ramifications and possible difficulties attendant upon setting up a new overseas circuit. During September, 1944, the Norwegian Government-in-Exile in London was first approached about proposed plans. At the time, the "V" bombs were hitting London heavily and, with their country still in German hands and victory not yet in sight, the Norwegian representatives were reluctant at first to make plans for service. Through the good offices of the American Ambassador to the Governments-in-Exile, however, an interview was secured with the Nor-

* See "Command Circuits," MAGAZINE, Summer 1946.

wegian Foreign Minister, who took an optimistic view, strongly favoring immediate negotiations for establishing direct connection with the United States. That official was Trygve Lie, little known then, but now well known throughout the post-war world as Secretary-General of the United Nations.

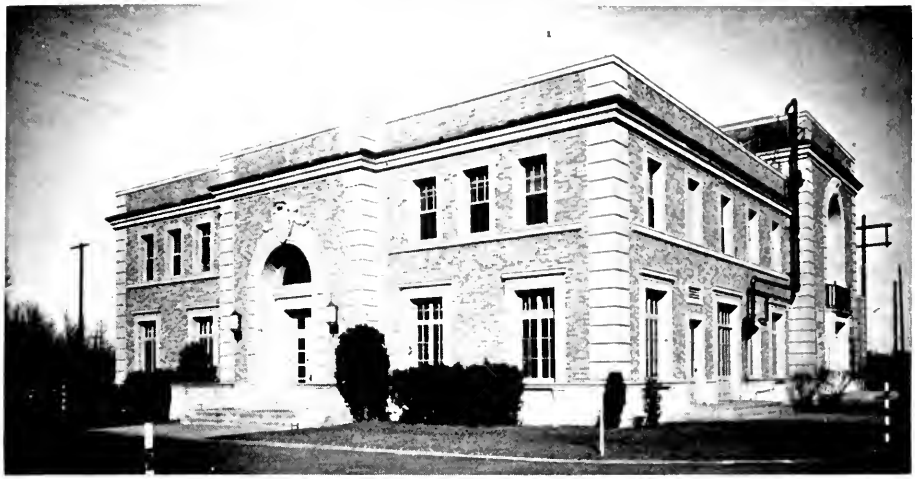
The next task was to convince the Norwegian Finance Minister of the soundness of the project. This was followed by a struggle to secure an early delivery date for the equipment in that particularly difficult period. Next, the Norwegians flew a naval commander to New York, where he was thoroughly instructed in the installation and maintenance of radio telephone equipment. Luckily, all went well, and soon after V–E Day the radio installation near Oslo was in progress. A Long Lines radio engineer flew up from Paris—where he had installed another new circuit to America for the French—and supervised the final Norwegian tests. The whole process moved smoothly, and the final results were completely successful.

What Is Involved in Opening a Foreign Circuit

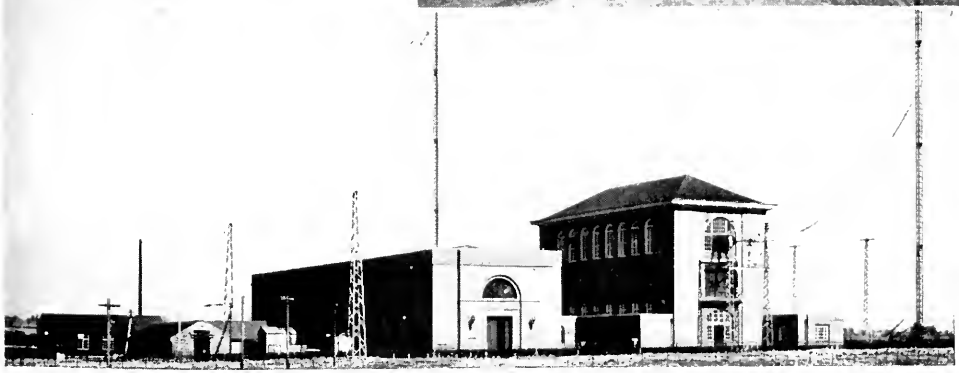
QUITE APART from its wartime overtones, the establishment of service with Norway presents factors always involved in opening a foreign service. At the American end, for example, transmitting, receiving, and control equipment must be installed and tested. In addition, a study of the crowded frequency spectrum must be made, and an application for new frequencies must be made to and a license to operate with the new country must be secured from the Federal Communications Commission. Negotiations with the foreign partner are required to determine rates and the division of revenues, and also to work out operating methods. Next, detailed operating procedures are sent abroad for study. As this work proceeds, the technicians are lining up the circuit for the use of the Traffic Department, completing over-all tests, and eliminating "bugs." Then the operators "meet" on the air to become acquainted with the different operating techniques of the new country, to insure a continuous flow of messages. Finally, after announcements to the press, the new service is established.

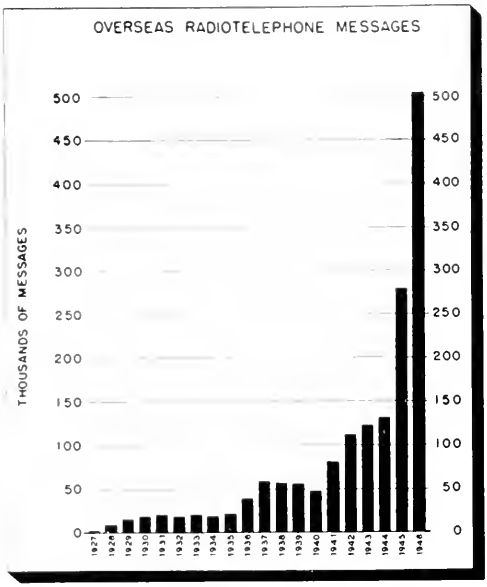
BUT PLANS do not always work out so smoothly. In some cases, the initial negotiations take months of persuasion and patience; sometimes the procurement of the equipment goes awry. On occasion, installations abroad have encountered difficulties and delay. Then too, foreign operators and technicians may need training. To this problem may be added the distance between the two terminals of the circuit, with differences in time, differences in language, and differences in operating technique. Yet, through the coöperation and comradeship which binds together communications people of all nations in a common endeavor, difficulties can be overcome and distances conquered.

Following the working out of such plans, and as soon as hostilities had ceased, radio telephone equipment abroad was rehabilitated or replaced, so that transatlantic and transpacific circuits could soon be established and



Above: The main building of the A. T. & T. Company's radio telephone transmitting station at Lawrenceville, N. J. At right: The transmitting station of the Companiá Radio Internacional do Brasil, near Rio de Janeiro. Below: The overseas radio telephone transmitting station of the British Post Office at Rugby, England





The 504,000 messages completed in 1946 compare with a pre-war maximum of 59,000 in 1937

overseas telephone service could once again meet the public demand for communication almost anywhere. Now, for example, the circuits with Hawaii and France number more than double the pre-war groups. Despite this increase, both routes are crowded with traffic. The circuits with Berne and Madrid—which continued during the war under restrictions—have been augmented by new facilities to meet the flow of unrestricted post-war traffic.

On the Heels of War

THE FIRST CIRCUIT restored with the European continent was that to Rome, due to the strange fact that the retreating German troops blew up the old-style massive high-powered transmitters in the Italian radio station—and by mistake left the relatively unimpressive modern short wave sets.

Paris was not so fortunate, since its transmitters for the United States were completely destroyed and even the building had to be replaced. However, two New York-Paris circuits were soon in operation, and now there are three.

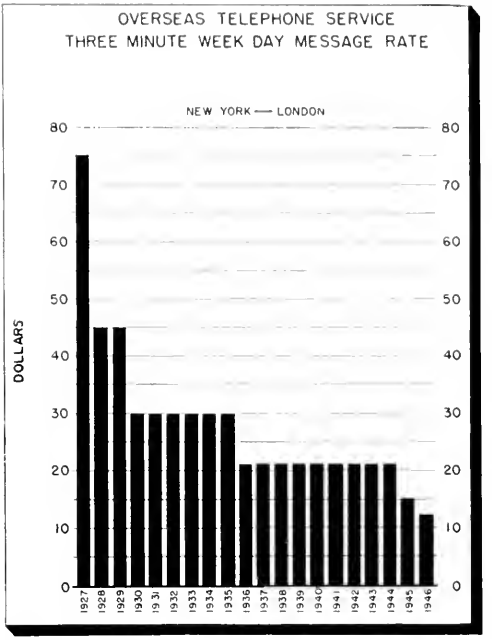
The Dutch did not regain Amsterdam until nearly the end of hostilities but, nevertheless, they were ready for service in short order. They did it by a clever stratagem. When the Germans invaded the Netherlands in 1940, the Dutch had just completed a new and modern transmitter. Just before the Germans arrived, it was dismantled, the various parts being specially marked and then put in a stockroom for "spare parts." There they stayed all during the war, with the Germans in control of the station. When they retreated, the Germans destroyed or took away all the assembled transmitters. But as soon as the enemy was out of sight, the Dutch started assembling the "spare parts." Soon two New York-Amsterdam circuits were in service.

Little Belgium, the first of the Europeans countries to be freed from Nazi rule, was most desirous of a direct connection with this country. So, in late 1944, soon after the country was liberated and just prior to the Battle of the Bulge, a Long Lines representative "hitch-hiked" into Brussels. The British military were not yet authorizing visits to their military area, which included the city—but a talk with the Belgians was vital if a circuit was to be speedily established. So, somehow or other, this telephone man found himself on a plane sitting among a load

of mail sacks for the American First Army, whose headquarters was at Charleroi—not far from Brussels. From the airfield he turned left instead of right and rode into Brussels on a British lorry.

To FIND lodgings without British orders was a problem, particularly in a city on a combat basis with buzz bombs still coming over. Luckily, a few American Army officers were there and one of them, finding that the visitor was from the A. T. & T. Company, exclaimed, "Why, you work for me. I own two shares of A. T. & T. stock!" Then he insisted that the British Town Major assign a proper billet, "because I own part of the company this chap works for."

Negotiations with the Belgian Minister of Communications were speedily and agreeably concluded. Then came the problem of how to return to London. During the negotiations, by another stroke of luck, the company representative had met a high-ranking American officer who, before departing on a trip to the front, asked that a valuable lace tablecloth be delivered to his wife in Washington. It happened that this officer was entitled to a seat on any British plane, the only means of reaching London. By a bit of bluff, and with the help of the officer's sergeant, who was anxious to have his chief's present delivered, the British Transport Office in Brussels was talked into assigning the plane seat of the American Officer to the company representative. So he flew back to London literally on the "lace tablecloth." On landing at Croydon, however, he had to talk fast to explain to the British why he should be allowed to enter a country which, according to the records, he had never left!



Rates for overseas service have been reduced until $12 is now, with a few exceptions, the maximum charge for a 3-minute daytime call anywhere

Advances in the art of radio telephony have made possible substantially reduced rates. Over the years, rates have been lowered by successive steps from the original charge, in 1927, of $75.00 for a three-minute conversation between New York and London. In the last two years, under a world-wide rate plan, telephone users in the United States may talk for three minutes almost anywhere for $12.00 or less. For distances less than 3,000 miles, the rates are lower than the $12.00 figure; the rate from the U. S. mainland to Hawaii, for example, is $7.50 for a three-minute day call. In many cases, there are lower rates for night and Sunday service.

The "lace tablecloth" circuit into Brussels, established soon after the one to Norway, is now carrying a good volume of traffic.

Service for Soldiers Overseas

IN THE MEANTIME, anxious to give the G.I.s in Germany contact with home, the American Army asked Long Lines to provide overseas circuits.* How this was accomplished is familiar to many, so it is sufficient to say that for more than a year circuits have been operating between Frankfurt and New York for G.I. calls from the United States Zone in Germany, and the service has recently been opened to public use. Ultimately, the temporary equipment and operations in Germany will be replaced by a permanent set-up. Two circuits for G.I.s also were set up to operate with Austria, and they too will be opened to public service.

Since V–J Day, the Pacific circuits are once again speeding telephone messages. The single Australian circuit, which during the war continued to carry government traffic, has been increased to two. A new circuit has been opened with New Zealand, which before the war was not a part of the overseas network. Service to the Philippines has been restored with two circuits. Tokyo also has two channels to San Francisco—but so far the traffic is confined to G.I. calls.

Telephone service with China was suspended shortly after the Japanese invasion, nearly ten years ago. However, new equipment is being installed at Shanghai, and two circuits will be in service shortly. Arrangements have also been made to reëstablish connections with Java and the other Netherlands Indies as soon as conditions return to normal in those troubled islands.

Prior to the war there was no telephone service between this country and Moscow although unsuccessful test trials had been made on a route through various European terminals. In 1943, in the midst of the world battle, a direct New York-Moscow radio telephone circuit was set up after months of effort. Restricted to government calls during the war, this circuit operated several hours daily —and continued on this limited basis long after all restrictions had been removed from other overseas services.

In Russia, the telephone is not the commonplace that it is in the United States. This led to an amusing episode during the international communication conference held in Moscow last Fall. When he was about to leave, the A. T. and T. Company representative learned that the Soviet plane carrying him to Berlin would land at the Russian military airport in Soviet-occupied territory, which is twenty-five miles from the American Area. Just prior to his departure, the company man asked if he could telephone Berlin to have an American car meet him at the Soviet airfield, but the Soviet officials replied that there was only a military circuit to Berlin. Whereupon the American asked for a call to Long Lines Headquarters in New York. The call was put through quickly, and the telephone man in Moscow asked New York to telephone the Long Lines representative in Berlin to have a car at the Russian airfield. This 9000-mile call for a taxicab amused the Russians and probably established a record for calling a taxi.

---

* See "Three-Minute Furloughs," MAGAZINE, Spring 1946.

Because of the increasing importance of communications between this country and the U.S.S.R., negotiations regarding this telephone link were held last fall in Moscow. These resulted in the opening of the service to public use without restrictions. Plans were also made to better the existing radio facilities, and these improvements were completed in time so that two circuits between Moscow and New York were available by the start of the Peace Conference.

Today the world telephone network has been restored to meet the greatly increased needs of the present day, and is much improved in capacity, diversity, and reliability over its predecessor of pre-war days. Now there are nearly sixty overseas circuits on more than forty direct routes in this service. Traffic across the oceans has reached a new high, having increased tenfold over the pre-war figure. In 1946, overseas telephone service put through more than 500,000 messages.

In 1947, world trade is only beginning to recover from the disrupting influences of the war. In war-torn areas, the machinery of commerce has been destroyed. World travel is limited by an insufficiency of planes and ships, and world commerce by lack of materials. Yet, despite these deterring factors, as a glance at the chart on page 48 shows, the trend of overseas traffic indicates vigorous growth.

WHAT of the future of overseas telephone service? The world-wide network of speech channels will be further extended to remote countries, and its message-carrying capacity will be supplemented and strengthened. Existing post-war overseas telephone facilities, which provide a much more substantial structure to furnish reliable service than the pre-war network, are ready to meet the challenge of future public demand.

In its twentieth anniversary year, overseas telephone service is passing from youth to manhood, from the developmental stage into general public acceptance as a vitally important social and economic instrument. Through planning, research, development, and common endeavor, it is the aim of those engaged in this enterprise to provide a service even faster, more reliable and—if possible—lower in cost. The task ahead is to advance voice frontiers still farther, by making overseas service more useful to more people in more countries.

After the recent observance of the twentieth anniversary of Bell System overseas telephone service, at which newspaper reporters conversed with various overseas points, one reporter wrote of his experience: "In fact, it went so easily it was as simple as—as—as making a telephone call."

That little black instrument at your elbow is Aladdin's lamp—by whose magic you can talk "with the rest of the known world." Reach out, lift the receiver, say the proper words, and lo! in a short time there is a voice from Rabaul, Paris, Honolulu, Moscow, or Rio.

Want to try it? It's just "as simple as—as—as making a telephone call."

Pioneer Chapters and Bell System Companies Undertake a Joint Project for the Compilation and Publication of the Story of the Start and Growth of Telephony

Preparing Histories of the Telephone Business

Samuel T. Cushing

In the years since Mr. Bell shouted "Mr. Watson, come here! I want you!" into an experimental telephone transmitter and Tom Watson came a-running, it has probably occurred to a great many people that it would be a splendid thing to have a comprehensive and accurate history of the beginnings and development of the telephone business. Some of them moved toward it, saving mementos and keeping records of events. But not for many decades was there any major effort to compile the facts and set them forth in permanent form as the history of a telephone company. Not, in fact, until 1932.

In that year Albert B. Elias was President of the Southwestern Bell Telephone Company. He was Senior Vice President of the Telephone Pioneers of America—and was to be president the following year. He had for some years sensed the need for a thorough-going history of the company.

That combination clicked. As Mr. Elias saw the need, so he saw how the Pioneers in the Southwestern Company could help to fill it. He asked the Pioneer chapters there to set about gathering historical data, and for a number of years they did so—with zest and zeal.

There was other information, corporate and statistical, which was a matter of record—and no less a part of history because it was readily available.

After some years the collecting and research were ended, and all the material was pooled, ready for the next step—compilation.

Here the Southwestern Company did more pioneering. For it recognized that gathering historical facts and writing history were two different things, and that the latter was a

job for a specialist. Thereupon the then editor of the company magazine, the *Southwestern Telephone News,* was detached from that position and given the assignment of writing, from the assembled material, the history of the Southwestern Company.

The product was a 360-page typewritten draft, bound in book form and placed in the hands of Pioneers and other Southwestern Company people for comment and suggestion upon both what the book says and the factual accuracy with which it says it.

That is its present status.* The status of the historian, Mr. Ralph Mooney, is now that of Historical Librarian of the American Telephone and Telegraph Company.

THE SOUTHWESTERN'S was not the only company history being written at that time. Independently, and without knowledge of the other effort, the Michigan Bell Telephone Company was also working on such a project. Before the war, historical compilation had been carried to the point where the record of corporate activities was completed and much of the history of the exchanges had been developed.

THE WAR interrupted still another and broader approach to this general topic of telephone company history.

In 1940 the Public Relations and Personnel Relations Departments of the A. T. & T. Company began to think seriously about the lack of basic and comprehensive company histories; and, on the basis of the successful Southwestern Company enterprise, they began to think about the Telephone Pioneer organization in connection with remedying that lack.

Members of the Pioneer chapter or chapters in each Associated Company appeared to be people who would have logical interest in collecting information about early telephone days. It appeared equally logical that the company should participate in this activity, since Pioneers—however keen their antiquarian interest—are not inherently either historians or accomplished writers.

This was the general import of the proposal which was made to the executive committee of the Pioneers' Association. That body approved the project as a joint undertaking of the Pioneer groups and the telephone companies, and at the 1941 meeting of the Pioneer General Assembly in Chicago it was placed before the representatives of the Pioneer chapters for their consideration as a coöperative endeavor with their respective companies.

A pamphlet which described the plan in detail was distributed at the meeting.

As outlined, the plan provided that a Pioneer chapter (or chapters in cooperation, in companies having more than one) would do the basic spade work of gathering all available facts on the beginnings and development —right down to the smallest exchange—of the telephone business in its territory. This would include garnering information from older and retired employees by personal interview or the use of questionnaires, from the various company records available, from old newspapers and magazines, and from any other

* See "The Telephone Pioneers of America," MAGAZINE, June 1943.

sources. In this very considerable enterprise the Pioneers would receive clerical and typing assistance from the company.

When this comprehensive collection of facts had been assembled, it would be turned over to a writer assigned by the Public Relations Department, who would proceed to develop it into a history of the company.

The consensus at Chicago was that there would be great value in the production of such histories. There would be assembled authentic facts about a company—its inception, its early days and early trials, its development since—all in one book. Not alone for speakers and writers on public relations matters, but for instances of public inquiry and for reference with regard to various phases of the business, the facts would be conveniently available. There would be, moreover, a real educational value in the volume—particularly for the younger employees.

After the Chicago meeting, the Public Relations and Personnel Relations Departments of A. T. & T. informed their colleagues in the Associated Companies of the matter and bespoke their assistance to the Pioneers in the new undertaking.

WITH THE historical project thus launched at Chicago in September 1941, some Pioneer chapters moved immediately to take up the work, and there were indications that there would be hearty coöperation from the companies. But December 7, 1941, soon came, and the country was plunged into war. Because of the pressure of war work, many companies were unable to lend the assistance they otherwise would have, and many of the chapters had to defer undertaking the work on company histories. Some, however, found ways and people to carry on the work; and a few chapters, with company coöperation, made good progress even during the war period.

Since the war's end there has been a considerable increase in the work, and it now appears that there will soon be very general resumption of the undertakings. Meanwhile, it is possible to report the development of some company histories on which considerable progress has been made.

The history of the Southern New England Telephone Company is practically completed, and the account of how it was written appears in the following pages of this issue. The Southwestern Bell history previously mentioned is in the hands of a writer who will carry it to completion, helped by the comments which have been made on the preliminary draft. The material for the Michigan Bell history, also mentioned earlier, is in typed form and is awaiting the skilled hand of a historical writer who will complete the exchange record and bring the corporate history up to date.

One company, after considerable voluntary work on the part of the three Pioneer chapters in its territory, has assigned a full-time employee in each of its three areas to head the historical committees of the respective chapters. Gathering of information has proceeded to the point that a writer has been engaged by the company to shape the history into final form.

In another company with three chapters, much historical informa-

tion had been gathered by the chapters, and more is being obtained. In addition, a special committee has been established at company headquarters to secure historical information from the company's files and records and to act as a general board of review. A basic outline has been agreed upon for the history, and a writer is already engaged in working over the material collected so far.

A company with one Pioneer chapter has assigned the secretary of the chapter to develop the company history in connection with his Pioneer work. Under this arrangement, an outline has been set up, much of the story is already written, and completion of the whole work is expected in 1947.

In another company, the secretary of the Pioneer chapter also has the joint historical-secretarial assignment and a number of chapters of the company history have been written. Of particular note here is the extensive historical library which has been set up by the chapter, with company cooperation. Company engineering records, corporate statistics and data, files of communications magazines, information gathered from "old-timers," clippings from newspapers, and a host of other items have been gathered together. Attractively bound, adequately cross-indexed, and housed in steel files and glass-front bookcases which may be locked as desired, this material provides a comprehensive reference source for those engaged in developing the history.

In yet other places, much of this preliminary work has been done: many questionnaires and records of interviews are on hand as source material; many clippings, manuscripts, and photographs of historical value have been accumulated; and further promotion of the work is being organized by the chapters and the companies. In some of the companies, historical booklets prepared for various occasions—anniversaries, for example—already contain many valuable historical facts.

As is no doubt evident, the purpose of this report is not merely to describe the process of developing this historical work but to cite encouraging progress in many aspects of the task. The fact that company histories will be of great value and interest to the people in the telephone business is being recognized in an increasing degree. It may be expected, therefore, that more and more of the chapters and companies will be including this project in their programs. Thus we move forward toward completing the picture which is being drawn of the telephone business from its humble beginnings in the 1870s to the present day.

The Present Southern New England Company Is Successor To the First Organization in the World which Operated A Commercial Telephone Exchange

Preparing a History of the Telephone in Connecticut

Edward M. Foley, Jr.

If a passer-by had happened to look through the plain glass window of a little ground-floor office in the Boardman Building in New Haven, Conn., at precisely noon on Tuesday, January 15, 1878, he might have seen a curious sight.

In the midst of an unornamented room cluttered with tools, wires, and small packing cases, and exhibiting on the wall a large, square board equipped with some kind of clock-dial contraption, three men were seated in "lawyer's" chairs about a plain kitchen table. All were in their early forties, and appeared at the moment to be absorbed in a serious ritual.

One, who bore a striking resemblance to Abraham Lincoln, sat on the edge of his chair, stiff and uneasy.

The second seemed to be engaged in surveying the other two shrewdly.

The third, a lean, keen-eyed, soldierly man, did most of the talking, now and then gesturing with nervous intensity. When he gestured, however, he used only his right hand, for his left arm hung limp at his side and he kept his left hand always in his coat pocket.

Sometimes, as the discussion waxed hot, he turned to appeal first to one man then to the other. Sometimes he pointed to the clock-dial contraption on the wall. Sometimes he read from a sheet of paper before him. Sometimes, when matters seemed to come to a head, he took a vote, and as each man raised his hand he recorded the result on the back of one of the blank telegraph forms which lay at his elbow. Then finally their business seemed to be finished.

What had been accomplished when the three men rose from that table was the formation of the District Telephone Company of New Haven, which thirteen days later was to open

in that room the first commercial telephone exchange in the world.

The men had been its three incorporators: Walter Lewis, superintendent of the New Haven Clock Company, who, with more than a little misgiving, had just put $600 of his life's savings into the venture, not so much as an investment as to help his brother-in-law, Herrick P. Frost, one of the officers of the new company; William H. Hayward of Norwalk, who represented the Bell interests as "Special Agent for Western Connecticut," and who was dickering for stock rights in return for the franchise; and George W. Coy, disabled Civil War veteran, telegraph manager, and inventor of the clock-dial switchboard, whose dream it had been for many months to found a commercial telephone exchange.

This was the first scene in the story which was eventually to unfold into the history of the telephone industry of Connecticut and of the present Southern New England Telephone Company. This was one of the many scenes which had to be recreated by the Telephone Pioneers of Morris F. Tyler Chapter as during the last three years they have gone about the task of preparing the history of their company—a history which is now in virtually final textual form and will be ready for publication within the present year.

The story of the preparation of this history is almost as interesting as the history itself. But first a word about how the work came to be undertaken at all.

In one sense the Southern New England Company has always been preparing to write its history; for almost from the beginning, various individuals have been collecting letters, memoranda, photographs, and other mementos with this end in view. The company magazine, *The Telephone Bulletin,* since its founding in 1907 has constantly published historical reminiscences; and since 1911 the constitution of the Telephone Pioneers of America, with its firm emphasis on historical aims, has fostered this tendency.

More recently, the example of the historical project of the Southwestern Bell Telephone Company, launched in 1932 by its then President A. B. Elias, one-time dynamic leader of the Telephone Pioneers, has also been a stimulus.

Getting the Go-ahead

But for the Southern New England the incentive moment, in so far as casting its history into a single authoritative volume is concerned, came in 1941 when the Telephone Pioneers at their General Assembly in Chicago officially recommended that all Bell affiliates prepare individual company histories.

With this recommendation before them, the Pioneers of Tyler Chapter immediately formed a historical committee and commenced work in earnest. The company guaranteed all necesary expenses, but the method of procedure was left entirely to the Pioneers.

The committee, represented by two of its members—ex-President Harry C. Knight and ex-Treasurer Ellis B. Baker, Jr.—drew up an outline of the scope of the work, and the General Information Department assisted

GEORGE WILLARD COY

A professional soldier, he came out of the Civil War with a disabled left arm, learned telegraphy, and later invented the first commercial telephone switchboard

WALTER LEWIS

He was first President of the District Telephone Company of New Haven—the first company in the world to operate a commercial telephone exchange

by sending various questionnaires to older pioneers. Returns, because of wartime conditions, came in slowly; but by 1943 so much material had been collected that the committee felt it was ready to engage a professional historical writer to put the work in final textual form.

THROUGH CONTACT with Yale University, one was found; and, in collaboration with the committee, he commenced writing early in 1944—proceeding, however, as he preferred, only on a part-time basis. Since then the work has progressed steadily, and as in its preparation almost every problem of telephone history has been met if not solved, it may be of some value to other companies contemplating histories to give an account of the steps in its composition.

The first major problem was where the story should begin.

The possibility of a single general introduction for all company histories was considered; but as the Southern New England boasted in its territory the first social, the first mutual, and the first commercial exchanges in the world, and as the history of these events went back to the early part of 1877, it was decided to go back a little further and begin with the invention of the telephone.

Subsequent experience also showed that no generalized history of the parent company would have served as a preface, since the progress of the various parent companies was intimately connected with that of the Southern New England and mutations in one caused mutations in the other.

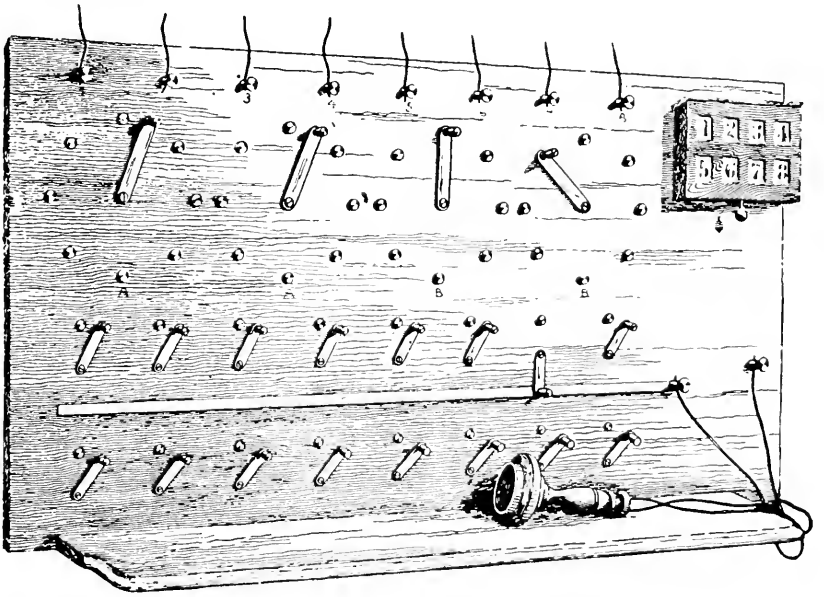
The corollary would seem to be, therefore, that any telephone company wishing to tell its own story properly must in some degree weave in the entire story of the industry.

The second problem was the length and scope of the book.

The historian, after surveying the material, suggested a work of 400 printed pages with a 400-word page, equal to 160,000 words, or between 500 and 600 typewritten pages. The general line of the story, it was agreed, should be the corporate history of the company and its predecessors, from the beginning up to the present time, embellished with a sufficient number of eyewitness accounts, personal anecdotes, and human-interest stories to give it life. Needless to say, these latter were eventually quoted *verbatim,* not only to retain their original flavor but to indicate that they were only anecdotes; for in the main body of the text the chief emphasis was on authenticity, and no amount of labor was spared to verify and document every statement of fact.

The greatest problem of all was how many persons should be mentioned in the story and how much space should be given to each one.

It was a delicate matter, and seemed a formidable problem, but it was solved, at the suggestion of the historian, by the simple device of adding biographical footnotes. Originally it had been planned to exclude nearly all footnotes, but the historian pointed out that the history of a telephone company is a form of local history and should be approached as such. In works of this kind, people are as important as events, and family history is one of the primary aims.

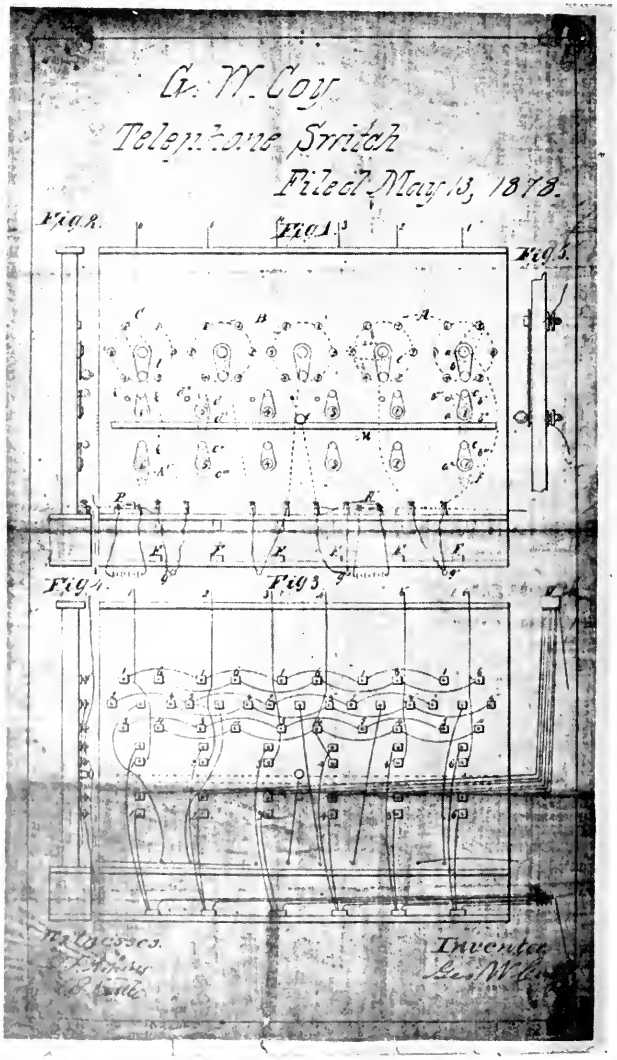


The granddaddy of them all. The world's first commercial switchboard as sketched by its inventor, George W. Coy. This invaluable drawing was made in 1905 at the request of a historically-minded pioneer. The original board was destroyed in 1879

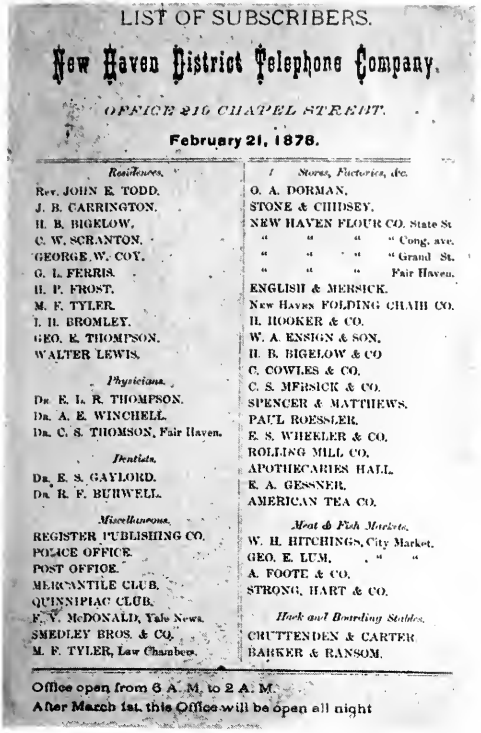
The force of this argument was allowed, and biographical footnotes —genealogical footnotes, they might be called, as they included everything from birth to death and from parents to children—were prepared for the founders of the company, for distinguished early pioneers of any rank, and for all later officers of the company down to the heads of the trifunctional organization. Similarly directors were given a brief biographical footnote of four or five lines, including dates, principal occupations and a few other pertinent facts sufficient to identify them thoroughly.

THIS biographical policy once established, the historian and the committee went to work on the main text.

The first step was to survey and catalogue the basic corporate records and other source materials, including the directors' minutes of all companies, the general managers' letter-books, early directories, ledgers, and files of old correspondence. Where there were gaps, as in the directory files, attempts were made to fill them up by advertising in the newspapers and buying old copies. Orders were also placed early with booksellers for rare magazines containing articles touching on the early days, as these orders usually took many months to fill. The corporate records, however, presented little difficulty, as the company was fortunate in having a complete run of directors' minutes from the beginning. To save wear and tear on some of



How it worked: a circuit diagram of the world's first switchboard, from a patent application never before published. Had this patent been granted, it would have been worth a fortune



LIST OF SUBSCRIBERS.

New Haven District Telephone Company.

OFFICE 216 CHAPEL STREET.

February 21, 1878.

Residences.

Rev. JOHN E. TODD.
J. B. CARRINGTON.
H. B. BIGELOW.
C. W. SCRANTON.
GEORGE W. COY.
G. L. FERRIS.
H. P. FROST.
M. F. TYLER.
I. H. BROMLEY.
GEO. E. THOMPSON.
WALTER LEWIS.

Physicians.

Dr. E. L. R. THOMPSON.
Dr. A. E. WINCHELL.
Dr. C. S. THOMSON, Fair Haven.

Dentists.

Dr. E. S. GAYLORD.
Dr. R. F. BURWELL.

Miscellaneous.

REGISTER PUBLISHING CO.
POLICE OFFICE.
POST OFFICE.
MERCANTILE CLUB.
QUINNIPIAC CLUB.
F. Y. McDONALD, Yale News.
SMEDLEY BROS. & CO.
M. F. TYLER, Law Chambers.

Stores, Factories, &c.

O. A. DORMAN.
STONE & CHIDSEY.
NEW HAVEN FLOUR CO. State St
" " " " Cong. ave.
" " " " Grand St.
" " " Fair Haven.
ENGLISH & MERSICK.
NEW HAVEN FOLDING CHAIR CO.
H. HOOKER & CO.
W. A. ENSIGN & SON.
H. B. BIGELOW & CO
C. COWLES & CO.
C. S. MERSICK & CO.
SPENCER & MATTHEWS.
PAUL ROESSLER.
E. S. WHEELER & CO.
ROLLING MILL CO.
APOTHECARIES HALL.
E. A. GESSNER.
AMERICAN TEA CO.

Meat & Fish Markets.

W. H. HITCHINGS, City Market.
GEO. E. LUM. " "
A. FOOTE & CO.
STRONG, HART & CO.

Hack and Boarding Stables.

CRUTTENDEN & CARTER
BARKER & RANSOM.

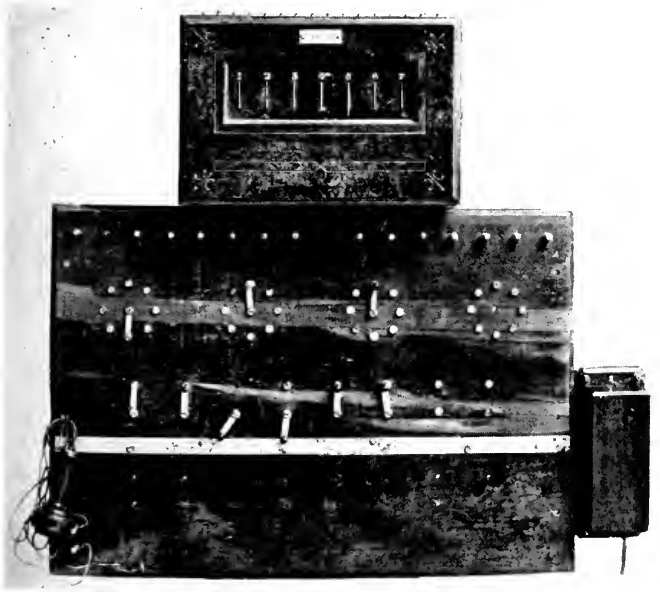
Office open from 6 A. M. to 2 A. M.
After March 1st, this Office will be open all night

Above: The world's first telephone directory. Subscribers at this time were called by name, not number

the earlier documents, photostats were made.

The next step was to interview some of the oldest living pioneers and get their stories before it was too late. Rapidly as this was done, however, the results were not what they might have been if the project had been started ten years earlier. Few of the real old-timers were left—only two, in fact, could claim to have seen the first commercial exchange in the world, and their accounts did not agree. To complicate matters further, a third old resident, not a telephone man, gave an entirely different description of the office. By the time the historian had located blueprints of the building, got the original ground plan reconstructed, and had a rough model made in order to settle the dispute, two of his chief informants had died. The events surrounding this incident constitute the most crushing disappointment connected with the entire project, for what has been lost in this case is absolutely irreplaceable.

WHAT the difficulties of research have been and how some of them have been overcome we may perhaps illus-



Old timer. The Meriden, Connecticut, switchboard, first placed in operation on January 31, 1878. Described by Coy as a "reproduction" of his original board, it is now in the Bell System Historical Museum at the Bell Telephone Laboratories

trate by going back to the little scene with which we began—the formation of the District Telephone Company of New Haven.

For the physical setting of that event we have as sources the personal recollections of the room supplied by the three informants above. They do not agree on the location of the door and the switchboard, but they do agree on the kitchen table and the chairs! The existence of the tools, wires, and straw-packed boxes of telephones we have ascertained from contemporary letters by Coy. The general appearance of the building we know, for it is still standing, though greatly altered. But we cannot find a photograph of what it looked like either inside or out in 1878.

Of the date and the time of the meeting we are sure, for we still have the little school composition notebook in which Coy wrote the original minutes. We also have the blank telegraph forms on which he took notes.

The attitudes of the men—their hopes and fears—we can reconstruct from their letters and from a brief account of the founding of the exchange which Coy wrote in 1905 at the request of General Agent Frederick Parker Lewis, one of those truly devoted pioneers without whose quiet, unsung labors of collection and preservation almost no Connecticut telephone history could be written today.

Of the three men in the scene, we know much about two, nothing about the third. When we began, all three were little more than names. We consulted old newspapers for obituaries—the Yale Library was fortunately close by—wrote to Civil War veterans' organizations, searched public archives, and, when these failed, tried to locate living relatives. It all took months of time. Finally we found Lewis's granddaughter in Long Island and from her got a biography and a good photograph. We had a photograph of Coy, but we got a better one from his son who, as it turned out, lived only ten miles from New Haven. However, it took us a long time to find him, and we wrote a good many letters and ran down a good many false leads before we did. We finally located him through the descendant of another pioneer, and through him we located others.

In fact, before we got through, we began to realize that nearly everybody in the local telephone business was somehow related to nearly everybody else and that they in turn were related to half the people in Connecticut. We thought it was a good thing for us to find it out—it reminded us of just how much a family business the telephone business is—and we think that eventually it will be a good thing for the people of Connecticut.

Of William H. Hayward, however, we have been able to learn nothing. We do not know where he was born, where he died, or what he looked like. He is the one character left in our story—out of some hundred and fifty names to which we have given biographical notice—whom we have been unable to identify. All the others we have found, some by getting their death dates and searching their obituaries in the newspapers, some by writing to relatives, some, and those very few, from biographical dictionaries. But where

we have used county histories or other local accounts we have usually verified dates by writing for birth and death certificates, for we have found there is a great deal of error even in standard works.

It has been the same with facts pertaining to the more formal aspects of company history. We have had to dig, and dig deep, and not take the first nugget that came along and call it gold. But it has been well worth while. The story of the struggle to survive and progress during the early years has been written in more detail than the history of the last twenty-five years of our growth. Our best results, our most interesting anecdotes, our most penetrating illuminations of company history, have usually come only after the longest search. But we have learned that the significant fact is always somewhere to be found, and that it is always

THE DISTRICT MESSENGER.

While we have many important demands upon all parts of the force, a great number of the calls are for messengers. It is hard to imagine an emergency, either great or trifling, in which this corps cannot, at very small cost, be of great assistance. They can be made to take the place of extra and costly servants of all sorts. They are uniformly polite, obliging and intelligent, quick-witted, capable of making purchases and bringing back change without "losing" any. They have greater strength and endurance than the ordinary house-servant, can go safely to neighborhoods and on duties in which a female domestic would be out of place, can give you as *much* assistance as you may require, and for the longest or shortest time, and subject you only to payment for the time actually consumed. If you need several messengers instead of one, they can be obtained with equal ease and speed.

It is a noteworthy fact that the messengers of this company are capable of *hurrying* and even of *running*. A single comparison of the time occupied by them and by a servant or ordinary errand boy in going the same distance, will astonish the employer of even most satisfactory help, while the intelligence, presence of mind and business sense of our messengers is such as cannot fairly be expected of any one not specially trained to such a business.

It is impossible to make a list of the purposes for which our messengers may be called, and equally hard to remember what they can *not* do. We therefore ask attention to the following list of demands (besides the ordinary one of carrying letters and messages) which *have* been fulfilled: To pay bill—to drug store for medicines—with check and answer—Young Men's Institute for books—for doctor and nurse—for two satchels—for umbrella—for butter—deliver package and collect money—for theater tickets—for cigars—in search of a husband—to hold a horse—to distribute handbills—for valise—for doctor—for groceries—to distribute cards—to go to a fair—to pay gas bill—for a coach—to search for a carpet layer—to Redcliffe's for a lobster salad—to return umbrella—to hospital for medicine—to church with umbrella—to drive a horse to stable—to Ferry's for ice cream—to carry manuscript to newspaper office—for shoes—for dry goods—for hymn book—to wheel baby carriage—for a plaster—for a cloak—to escort lady and child to depot—for milk— for wine—for a minister—for fish—for carpet bag—to collect bills—for shirts—for tobacco—to pawnbroker's—to take child to its grandmother's—to carry two boxes silver ware—to obtain a servant—to attend door-bell four hours—to deliver hats for manufacturer—to deliver wedding cards—for chicken salad—to buy bouquet—to serve a process—to buy a chicken—to mind an office—borrow wash-boiler—to make deposit in bank—to get lady's watch repaired—for bird seed—to distribute election tickets—to buy seats in drawing-room car—to attend a bar—to trace property left in horse car—for a musician—to get check certified—to express office—for a pail of lager—to buy fruit—to pay tax-bill—to carry package anywhere—to several doctors—for barber to shave sick man—for mineral waters—to church with flowers—for nurse—to market for meat—to bring a notary public—to take child out for a walk—for sleeping car section—to send telegram—to find a plumber—for lunch to be sent to residence—for a demijohn of whiskey—to dressmaker—to find man to clean stove—to bring children from school during a heavy rain—to Gallagher for cigars—etc., etc.

Customer appeal in the old days. A page from the directory of the Connecticut District Telephone Company, November, 1878

worth the extra effort required to find it.

All this may imply that we have labored to attain accuracy at the expense of interest, but this is not so. We have everywhere striven for readability, for the personal touch, for an emphasis upon people rather than things. Some of the salty phrases of the old pioneers have been well worth preserving, and we have preserved them.

One old-timer in describing the setting of poles in the early days averred that "they were usually set by hand but that when the going got tough they were sometimes lifted into place by sheer force of the foreman's language." He added that when a lineman was caught stringing wires on houses without permission "the order of retreat usually depended on the size of the man that caught him."

Similarly an anecdote preserved by Frederick Parker Lewis gives us a lively—or the reverse—picture of Herrick Frost, one of the founders. Frost, as Lewis recalls, was a short, stocky man with black hair and a full beard who, although he dressed plainly, was seldom without his high silk hat even while in the office. The hat was an index of Frost's mood. If perched upon the back of his head, all was well; if pulled down over his eyes, this barometer indicated stormy weather.

But Frost had a well developed

Where it all started: the Boardman Building (right), New Haven, Connecticut. In the store just back of the penny scale the first commercial exchange in the world was opened on January 28, 1878. This photograph, from the Arnold G. Dana collection, was taken in the 'nineties, looking westward on Chapel Street

sense of humor which he could use to suit his purposes. His favorite attitude was one of deep reflection, with his feet on his desk and his silk hat down over his eyes. When he assumed this attitude, people passing him or even speaking to him got no notice or response. A visitor, on one such occasion, half recognizing him, but still a bit uncertain, approached and asked if Mr. Frost were in the office. So deep was his abstraction that Frost shook his head negatively. With a somewhat incredulous look, the visitor left.

These are the lighter touches, but they are not the principal story.

What that consists of is a clear-cut picture of the organic growth of a company, a system, and a service. It is a story of a part of American life, of a great technological and business achievement, and of a contribution to the industrial might of the Nation. It is a story of small courageous beginnings, of difficulties met and conquered, of personal heroism, and of individual character in action both in the office and the field. It is a worthy tribute to men and women who deserve to be long remembered. The success of our enterprise was won in part by earlier pioneers who paid for it a much higher price than we have.

Summing up, it is the living tradition of the telephone business in tan-

Before the curtain rose: the corner of State and Chapel streets, New Haven, in the early seventies. The Boardman Building, site of the first commercial exchange, later replaced the structure to the left. On August 1, 1878, the exchange moved to the upper floor of the Brewster Building. The tower in the rear is that of the old New Haven railroad station

gible form, a work for the old to peruse and remember, for the young to absorb and emulate. It is at once a monument and milestone, pointing the way we have come and the way we shall go. For as there were pioneers of old, so are there pioneers today, and so will there be pioneers hereafter; and it is our duty and privilege to honor those who went before as we ourselves may wish to be honored by those who shall follow us.

It is with this thought in mind that the Telephone Pioneers of Connecticut have prepared this history of their company.

From Edinburgh

UNDOUBTEDLY the longest talk of the centennial ceremonies—geographically speaking—was that of the Lord Provost of Edinburgh, the Rt. Hon. Sir John Falconer, who spoke by transatlantic telephone with Mr. Frederick Johnson, President of the Bell Telephone Company of Canada. Sir John said in part:

"On behalf of the City of Edinburgh it is a pleasure to greet you in connection with the 100th anniversary of the birth of one of this city's most distinguished sons. It is fitting, too, that my greetings should be carried by the telephone which the genius of Alexander Graham Bell made possible. . . .

"Edinburgh is proud to join in tribute to a native son who was not only a great inventor, but a great humanitarian. Genius, Mr. Johnson, is a major Scottish export. We in Scotland are proud of the native talents of Alexander Graham Bell and of his sterling character; and we are proud to think that a Scottish education contributed somewhat to his success. . . .

"If international telephone communication has not brought peace among all nations, it has at least bound closer together all men of good will, scattered though they may be in all parts of the world. . . .

"On behalf of the people of Edinburgh, I am glad to have had the opportunity, not only of paying tribute to Alexander Graham Bell, but of speaking to you in the Dominion of Canada."

Who's Who & What's What *in This Issue*

An issue which observes the centennial of the birth of Alexander Graham Bell, twenty-five years of its own continuous publication, and twenty years of overseas telephone service may quite properly be designated an "anniversary issue."

As is fitting, two distinguished Bell System officials lead off our report of the Bell centennial observance: Walter S. Gifford, President of the American Telephone and Telegraph Company, and Dr. Oliver E. Buckley, President of the Bell Telephone Laboratories.

Joining the Bell System in 1904, it took Mr. Gifford just under 21 years to go from payroll clerk in the Western Electric Company to the System's top job: President of A. T. & T. Company—even with time out for an important part in World War I in civilian executive capacities. More than twenty-five years later, in the recent war, he was Chairman of the Industry Advisory Committee of the Board of War Communications.

Concerning Mr. Gifford's many charitable, educational, and scientific interests it is perhaps sufficient to cite that a few years ago he received the gold medal of the National Institute of Social Sciences in recognition of his services "as Director of the Council of National Defense; President of the Charity Organization Society of New York [now the Community Service Society]; Trustee of Johns Hopkins University, General Education Board, Carnegie Institution of Washington; Director of the President's Organization on Unemployment Relief; President of the American Telephone and Telegraph Company, the greatest non-governmental organized service in the United States; and as trustee of numerous educational and scientific foundations."

Mr. Gifford's most recent appearance in this Magazine was in the issue for Autumn 1944, which carried his address to the U. S. Independent Telephone Association on October 11 of that year.

Dr. Buckley entered the Bell System in 1914 as a research physicist; became assistant director of research of the Laboratories in 1927, and director in 1933; was made executive vice president in 1936; and was elected president in 1940. During the previous war he had charge of the U. S. Signal Corps laboratory in Paris, with the rank of Major. He is a fellow of several scientific and engineering societies, and is a member of the National Academy of Sciences, the American Philosophical Society, the National Inventors' Council, and the Research Board for National Security. His previous contribution to this Magazine was his stirring "Bell Laboratories in the War," in the Winter 1944–45 issue.

A decade ago, when the anniversary of overseas radio telephone service was but the tenth, William G. Thompson contributed to the Bell Telephone Quarterly an article called "Making Neighbors of Nations." His "America Is Calling," in this issue, is not just an account of the following 10 years' extension of overseas circuits but a yarn of war-time expedients and post-war recovery as well as an augury of even greater developments a-coming. One of the few state secrets to escape from behind the iron curtain is that it was he who called from Moscow to Berlin via New York last fall to summon a taxi.

William G. Thompson

Samuel T. Cushing

Edward M. Foley, Jr.

Mr. Thompson joined the Long Lines Department in New York in 1914 as a rate clerk, and by 1923 he had become commercial engineer. Following a brief period in the O. & E. Department of A. T. & T. he returned to Long Lines in 1929 as assistant to the general manager, with duties related to overseas and ship-to-shore radio telephone service, contacts with foreign countries, and other new developments. In 1940 he was appointed assistant vice president and made responsible for overseas service, and in 1944 he was made head of an executive staff which includes those duties among others.

Mr. Thompson received a War Department citation "for initiating the development of the multi-channel radio teletypewriter system and for directing the training of military personnel in the installation and operation of this equipment"; and takes scarcely less pride in having been able, along with such wartime responsibilities, to serve for five years as chairman of the Scarsdale-Larchmont draft board.

An article by Samuel T. Cushing entitled "The Telephone Pioneers of America," published in this Magazine for June 1943, carried in its subtitle the phrase "This Group of Telephone Men and Women Forms a Strong Link between Achievements of the Past and Greater Accomplishments Still to Come." The Pioneers are the logical people, it is clear, to cherish, explore, and bring forth the facts of telephone history and make them available to telephone companies for compilation and publication. How such a general program is progressing in the Bell System is the theme of Mr. Cushing's contribution to this issue.

In plant work with the New England Telephone and Telegraph Company from 1906 to 1927, he was on the staff of the plant operation results engineer of the A. T. & T. Company for the next dozen years until, in 1939, he was appointed a staff assistant in A. T. & T.'s Personnel Relations Department and made Secretary of the Telephone Pioneers.

From the general to the specific is the step from Mr. Cushing's article to that of Edward M. Foley, Jr.: an account of how the history of one telephone company was prepared. The author last year completed a term as Senior Vice President of the Telephone Pioneers of America, and is now serving as Secretary-Treasurer of Morris F. Tyler Chapter.

Joining the Southern New England Telephone Company in 1909, Mr. Foley began his telephone career by doing part time clerical work at New Haven while attending high school. In the intervening years he has held various assignments in the Accounting Department. He became statistical supervisor in 1926 and chief accountant in 1937, and since 1941 has been the company's auditor of disbursements.

Summer 194

Tel MAGAZINE

The Responsibility of Management in the Bell System
WALTER S. GIFFORD

Helping Customers Improve Telephone Usage Habits
JUSTIN E. HOY

Employees Enjoy more than 70 Out-of-hour Activities
JOHN G. SIMMONS

Keeping Our Automotive Equipment Modern
TEMPLE C. SMITH

merican Telephone & Telegraph Company · New York

Bell Telephone *Magazine*

Summer 1947

The Responsibility of Management in the Bell System,
Walter S. Gifford, 70

Helping Customers Improve Telephone Usage Habits,
Justin E. Hoy, 72

Employees Enjoy more than 70 Out-of-hour Activities,
John G. Simmons, 81

Keeping Our Automotive Equipment Modern,
Temple C. Smith, 90

Mark Twain and the Telephone, 100

Crossed Wireless, 104

Twenty-five Years Ago in the Bell Telephone Quarterly, 105

Who's Who & What's What, 107

A Medium of Suggestion & a Record of Progress

Published for the supervisory forces of the Bell System by the Information Department of American Telephone and Telegraph Co., *195 Broadway, New York 7, N. Y.*
Walter S. Gifford, *Pres.;* Carroll O. Bickelhaupt, *Sec.;* Donald R. Belcher, *Treas.*

The Responsibility Of Management In the Bell System

Walter S. Gifford

President, American Telephone and Telegraph Company

It used to be that the owners of practically every business were themselves the managers of the business. Today, as far as large businesses are concerned, a profound change has taken place. In the Bell System, for instance, employee management, up from the ranks, and not owner management, is responsible for running the business. This management has been trained for its job in the American ideal of respect for the individual and equal opportunity for each to develop his talents to the fullest. A little thought will bring out the important significance of these facts.

Management is, of course, vitally interested in the success of the enterprise it manages, for if it doesn't succeed, it will lose its job. So far as the Bell System is concerned, the success of the enterprise depends upon the ability of management to carry on an essential nation-wide telephone service in the public interest. This responsibility requires that management act as a trustee for the interest of all concerned: the millions of telephone users, the hundreds of thousands of employees, and the hundreds of thousands of stockholders. Management necessarily must do the best it can to reconcile the interests of these groups. Of course, manage-

ment is not infallible; but I maintain that, with its intimate knowledge of all the factors, management is in a better position than anybody else to consider intelligently and act equitably for each of these groups—and in the Bell System there is every incentive for it to wish to do so. Certainly in the Bell System there is no reason either to underpay labor or overcharge customers in order to increase the "private profits of private employers," for its profits are limited by regulation. In fact, there is no reason whatever for management to exploit or to favor any one of the three great groups as against the others and to do so would be plain stupid on the part of management. The business cannot succeed in the long run without well-paid employees with good working conditions, without adequate returns to investors who have put their savings in the enterprise, and without reasonable prices to the customers who buy its services. These conditions have been well met over the years in the Bell System.

Admittedly, this has not been and is not an easy problem to solve fairly to all concerned. However, collective bargaining with labor means that labor's point of view is forcibly presented. What the investor must have is determined quite definitely by what is required to attract the needed additional capital, which can only be obtained in competition with other industries. And in our regulated business, management has the responsibility together with regulatory authorities to see to it that the rates to the public are such as to assure the money, credit and plant that will give the best possible telephone service at all times.

Bell System employees have recently received increases in pay which management agrees are fair but which in most cases will result in earning less than an adequate return for investors pending the time management, with the approval of state regulatory authorities, secures increases in telephone rates.

It is my confident expectation that telephone management will soon again balance fairly the interests of all the parties concerned and go forward in its great task in providing more and better telephone service at a cost as low as fair treatment of employees and a reasonable return to stockholders will permit.

Assisting Business Firms to Improve the Quality of Their Telephone Contacts is an Important Part of Bell System Servicing Activities

Helping Customers Improve Telephone Usage Habits

Justin E. Hoy

"WHO IS HELLO?" This poser is fast assuming its place on the roster of unanswerables, along with its more famous peer, "How long is a piece of string?"

Although someone once defined the length of a piece of string as twice the distance from its center to either end, no one has yet attempted to identify "Hello." Putting "Hello" in its proper place as a poor response to the telephone ring is just one phase of the many-sided job undertaken by the Bell System to improve the telephone usage habits of business customers.

This job is important because it helps those customers to use telephone service more efficiently—thus enabling them to meet their communication requirements with a minimum of facilities. In addition, it contributes to the rendering of a faster and more pleasing service, which in turn encourages use of the telephone as a medium for doing business. These matters are significant to customers and their employees, and to the Bell System's operating companies as well.

The Elements of Good Usage

GOOD telephone usage is made up of three distinct elements: technique, tone, and effectiveness.

Good telephone technique merely means doing naturally those things which all of us do consciously when we stop to think but sometimes fail to do when we are in a hurry or get careless. Answering the telephone promptly, and answering by name or department, for example.

Good tone in telephone contacts is essentially the evidencing of warmth, interest, and sincerity through the use of a friendly, natural, and cheerful voice.

Calls are considered effective when

"Telephone Courtesy" — the Bell System's motion picture on good usage. Above: A scene showing a customer's own program, with two of his employees demonstrating a telephone call to their fellow workers. At the right is a view of the picture in the making

they accomplish the purpose for which they are made.

ANSWERING the telephone correctly is a simple thing, yet poor answering habits are numerous. We have all encountered the "busy executive" who unconsciously puts his hand on his telephone the second it rings but continues to carry on a conversation with someone at his desk while the telephone rings on and on.

A variation of this is the man who lifts the transmitter to his mouth immediately but continues the conversation with the person who is present, thus permitting the calling party to get a real indication of how busy he is.

In this same category are the poor answering phrases: "Hello," the casual "Yes?", and the newly smart "For whom doth the bell toll?"

These instances of how not to answer the telephone interfere with efficient use because they may cause the line to be held longer than necessary and thus are wasteful of facilities. Failure to answer promptly, and to let the calling party know with whom he is connected, may be annoying.

Other obvious things to watch in using the telephone correctly include calling by number, placing and an-

Many customers prepare booklets to instruct their own employees in the use of the telephone *

swering one's own calls, leaving word as to one's whereabouts when away, and answering for others in their absence. It is fundamental, of course, to speak clearly and directly into the transmitter and to end a call courteously, being careful to replace the receiver gently. Failure to do these things can also slow up service, be wasteful of facilities, or cause annoyance.

A telephone contact may not fall short in any of the foregoing and yet be lacking in warmth, interest, or sincerity—in other words, be lacking in tone.

This matter of tone concerns not so much what is said as the way it is said; for in a telephone conversation the voice is the only means of conveying impressions which in a face-to-face conversation would be created by a smile or gesture.

Common tone deficiencies fall into two broad categories: (1) failure to show interest and willingness to serve; and (2) failure to be sincere.

We said earlier that telephone calls are effective when they accomplish the purpose for which they are made. Let's consider, for instance, a telephone in a department store in-

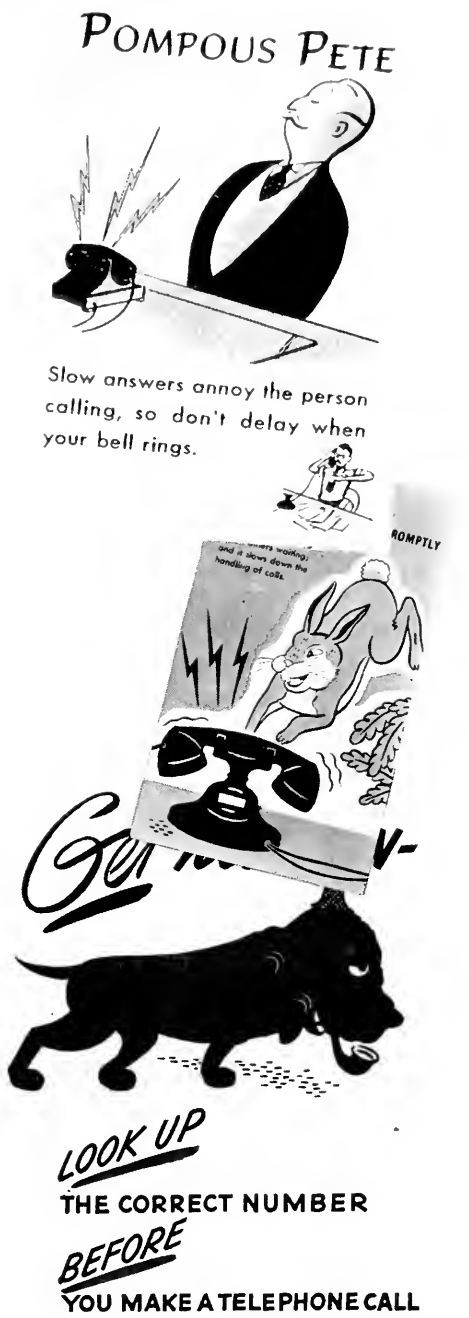
* Illustrations courtesy of Trans World Airline, Sears Roebuck & Co., New York Central System.

tended for taking orders: i.e., selling merchandise. To the extent that orders are taken inaccurately—packages sent to Vine instead of Pine Street, for instance—the telephone would be used ineffectively. If a customer calls for an out-of-stock item and is not offered suitable substitutes, the telephone call would not have served its purpose completely, from the standpoint of the customer or the store. Such matters as giving and obtaining complete and accurate information over the telephone and taking advantage of sales opportunities increase the value of the service—which in turn results in its more extended use.

The Opportunities at Hand

So much for the definitions. Now let's take a look at what the opportunities are, and how the System is taking advantage of them.

In the first place, the job of stimulating better telephone usage practices among business customers is usually a responsibility of sales and servicing people in the Commercial Department of the operating companies. For years these people have helped customers to determine what telephone facilities best meet their communication requirements, and this experience provides a valuable background for the job of promoting good usage. Opportunities for usage improvement arise from customer requests for assistance; or more generally are uncovered by servicing representatives in the course of their regular work. Especially is this true in the case of the larger firms which have many employees and make and receive large numbers of calls.



Two posters and a blotter: examples of colorful material furnished to customers to foster their employees' interest in good telephone habits

Paralleling the work of the commercial people is the activity of the Traffic Departments to increase the efficiency of customers' switchboard attendants. This work is directed not only at maintaining a high level of proficiency in the technical details of switchboard operation on the part of attendants but also at insuring continuing development of good tone and intelligent handling of calls.

Improvement in the calling habits of a firm's employees is usually obtained by programming a series of activities all of which are designed to get across the one story.

Before such a program can be laid out, however, it has been found important to get the customer's agreement to two basic principles. These are, first, that a good-usage program is desirable and has the customer's full backing; and, second, that the customer will devote continuing interest and cooperation to the project. Unless these two conditions obtain, the work of telephone company representatives is handicapped. For if customer management is not wholeheartedly behind the program, effective action may or may not be taken: the project becomes "an idea of the telephone company" rather than something of the customer's initiative. If the customer is unwilling to devote continued interest to the good-usage theme, bad telephone habits which have been temporarily eliminated will sooner or later reappear.

GOOD-USAGE programs which are designed to correct existing faults have been highly successful.

They involve, obviously, determining the shortcomings of existing practices. This is usually done by observing the manner in which employees handle telephone calls. Another way is to make a series of test calls to selected departments. This is a particularly good way to form a judgment because opportunities to display initiative may be purposely given the employee.

The usual method of introducing ideas for improving telephone practices is to arrange group meetings of all a firm's employees, including its executive management. At these meetings either a representative of the customer or the telephone company representative addresses the group, pointing out common practices which could be improved and stressing desired procedures.

To be effective, such addresses must be made interesting. The use of working telephone equipment to demonstrate the "right way" and the "wrong way" is very helpful. A Bell System film "Telephone Courtesy" has been found to be a fine vehicle for getting across ideas on correct and incorrect usage. Giving voice demonstrations on the mirrophone has been a popular way to portray proper tone. Distribution of appropriate printed matter supplied by the telephone company usually takes place at such meetings.

The telephone representative can give only the original impetus, of course. Once the ball is started rolling, it is up to the customer to keep it rolling. Some firms give all their new employees a brief course on good telephone usage, which is "refreshed" from time to time. Others designate particular employees whose full-time responsibilty is to keep employee interest alive. This they do by such things as distributing booklets, dis-

playing bulletins and posters, and making surveys to determine the quality of telephone contacts.

One interesting follow-up plan used a firm's public address system. At intervals the sound of a telephone bell was broadcast through its loudspeakers. At the end of the second ring a voice announced, "No that really wasn't your telephone ringing that time. But if it had been, would you have answered it promptly? Our telephone is a production tool. When you delay in answering your telephone, you tie up busy lines. Please answer promptly." The messages were varied to emphasize other points, and the plan proved to be highly effective.

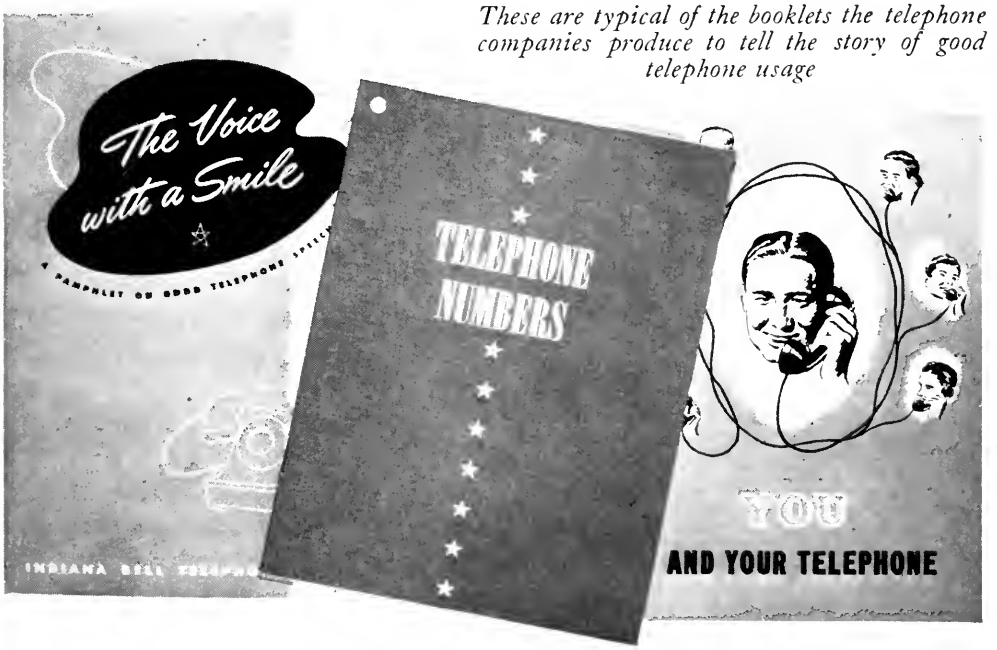
Another plan involved the use of reminder slips originated by switchboard attendants. After all employees had been informed of the plan and its purpose, the attendants would send reminder slips to those employees whose telephone habits had been noted as being below the firm's standard. The reminder would point out the mistakes made and ask for future coöperation.

Illustrative of the material which has been prepared and distributed by both the telephone companies and customers are colorful booklets, blotters, posters, and booklets for frequently-called numbers. Many firms have devoted space in their own magazines to the subject, and have prepared manuals or other instructive material.

A large banking institution has gone to the expense and expended the effort to produce slide films outlining proper telephone procedures.

One of the large automobile manufacturers has recently written all branch distributing and warehousing points, describing a service-improvement job done in Detroit and suggest-

These are typical of the booklets the telephone companies produce to tell the story of good telephone usage



A telephone representative conducts a special class on good telephone usage with a customer's employees—in this instance a selected group from a large air transport line

ing that each branch do something along similar lines.

Business executives are keenly interested in the general program. Recently the Dartnell Corp. of Chicago conducted a survey of 125 business organizations to determine what executives thought about telephone courtesy. Some of the conclusions reached were:

> Almost all the executives interviewed were eager to do something to improve the situation in their organizations.
>
> Over half of the firms surveyed felt they could easily improve their existing telephone practices.
>
> Most of the firms which had launched a good-usage program recognized the importance of "follow-through."

A Worth-while Activity

Because of the many intangible benefits which customers receive as a result of these good-usage activities, it is difficult to measure accurately their full value. The cordial response of business executives is in itself testimony that the work is worth while. Perhaps typical is the following statement, quoted from a letter signed by the vice president of a large manufacturing concern:

> "We feel confident that this [program] will gain for us and our company a number of valuable friends. . . . Your program seemed to strike a vibrant chord. . . . At some later date we would like this fine program repeated. In the meantime, we would appreciate your keeping us supplied with a reasonable amount of follow-up literature."

Many such letters have been received.

A large railroad which has paid particular attention to the matter during the past few years estimates a

Kind of Business	Speed of Telephone Answer: Average Seconds, Before Study	Average Seconds, After Study	% over 30 Seconds, Before Study	% over 30 Seconds, After Study
Steel Tank Co.	24.2	14.2	19.6	8.7
Can Manufacturer	18.7	13.3	12.0	10.9
Aircraft Equip. Co.	25.0	12.9	19.8	5.5
Express Co.	20.6	16.0	15.7	10.3
Commercial Airline	19.7	9.5	14.9	3.0
Food Machinery Co.	25.1	17.3	15.5	13.0
Railroad	22.9	15.6	15.7	11.5

95 percent improvement in telephone courtesy and effectiveness.

In Southern California, studies were made at a number of PBX switchboards before and after good-usage programs were conducted, to determine the effect on the speed with which employees answered their telephones. Some of the results are shown in the accompanying table.

Other Activities

In addition to activities with specific customers, much effective work has been done to spread the gospel of good usage among groups.

Luncheon clubs and civic and social organizations have received with enthusiasm telephone company speakers. The film "Telephone Courtesy" is adapted to such gatherings and has been shown many times.

Telephone company representatives have also appeared before conventions of advertising executives, sales managers, office managers, and similar interests.

Some secretarial schools have as a part of their curriculum a course on telephone manners and pleasing procedures. Schools consider lectures on this subject desirable, and telephone representatives have filled such engagements.

In some cities, the extent of the good-usage job has made it desirable to organize especially for it within the Commercial Department.

An example of this is in New York City, where last year seven customer service consultants, as they are called, and their supervisor made up an organization of specialists. These people were selected with particular attention to their public-speaking ability and voice characteristics. A training manual was developed, and each of the consultants received instruction in subjects varying from "How to conduct mirrophone demonstrations" to "Training of selected customer personnel as consultants."

Among other activities, this group was responsible during the year for more than 100 customer surveys and conducted programs attended by about 22,000 people. In addition, individual training was given to many customer employees, who in turn act as consultants within their own companies.

This work of the telephone companies to stimulate good telephone usage

Message to executives. This telephone company representative is addressing a group of advertising men on the importance of good telephone usage

among business customers is a soundly established and continuing activity. For while it is the responsibility of customers—and to their own advantage—to keep alive within their organizations an appreciation of the benefits of good telephone habits, it remains also the concern of the telephone companies as long as poor telephone habits utilize facilities needlessly, slow up service, or otherwise detract from the effectiveness of the telephone as a means for doing business.

The Bell System found out long ago that it isn't enough to build the plant and complete the calls. We must also help customers get the best use and the most satisfaction out of the service.

Athletic, Social, and Cultural Activities Sponsored by Employee Groups Offer Bell System Men and Women Many Opportunities To Cultivate a Variety of Interests

Employees Enjoy more than 70 Out-of-hour Activities

John G. Simmons

THE PHRASE "He flies through the air with the greatest of ease" might refer to a song popular a decade or so ago, or even to an "aerial artist" in a circus; but a certain group of air-minded telephone employees would undoubtedly assume that it was describing the week-end activities of the members of their flying club.

What is this flying club? The answer is twofold: it is a group of forty people meeting every Saturday and Sunday at a local flying field for instruction and practice in flying; and it is also one of the many recreational activities sponsored by and participated in by groups of Bell System employees.

What are these leisure-time recreational activities which arouse the interest of telephone people? Who *are* the interested employees? Why do they like to engage in these activities? How do they become interested? How are the activities organized, and what equipment and facilities are required?

Such questions have been asked many times. They indicate a rather general interest. Hence this endeavor to provide at least some of the answers.

Athletic and Social Activities

A SURVEY made recently in the Bell System showed that there are more than seventy different kinds of recreational activities presently under way among employee groups. The term "recreational" as used here is applied to a wide variety of employee leisure-time interests: athletic, social and cultural. These activities range all the way from vigorous forms such as softball, basketball, and the like to the less strenuous but equally absorbing types such as stamp collecting.

Bowling is found to be a part of the men's and women's program more

Crafts and collections of every sort are found among the hobbies of Bell System people. Here is a corner of a "hobby show"

often than any other activity. Since bowling competition involves team play, it follows that the greatest number of teams take part in this sport. The employees in every company in the System have their bowling teams, and in most instances the teams compete in both departmental and interdepartmental leagues. In some cases company teams participate in industrial bowling leagues and inter-company matches.

Softball has its adherents, not only among the men but among the women as well. Here, too, teams are organized into leagues. Other sports which parallel are basketball and volleyball—although participation in the latter has been limited, up to now at least, to the distaff side. Perhaps it isn't surprising that most of the participants in these three sports just happen to be the younger telephone people.

Sports activities which seem to appeal to telephone men rather than to telephone women are handball, badminton, squash, fishing, flying, horseshoe pitching, rifle club and shooting activities, and sailing.

There are, however, several programs in which men and women jointly take an active part: golf, horseback riding, bicycling, roller skating, archery, swimming, table tennis, skiing, tobogganing, and ice skating.

While telephone company bridge leagues and tournament play have not as yet inspired a Webster bridge cartoon, they have provided interesting post-mortems of a non-deadly variety. Other table games which collectively vie with bridge in the number of ardent adherents include checkers, chess, skat, and pinochle. Some of these activities are formal-

ized through clubs, as in the case of chess, and tournament play is a regular feature of the program. Also, arrangements are made to provide courses of instruction for both individuals and groups, and members and non-members of the groups engage in informal play during noon hours.

Dances, minstrel shows, banquets, theatre parties, hay rides, sleigh rides, hikes, and picnics have the enthusiastic support of telephone people in many places. Sponsored by many different groups, large and small, employee parties and dances range from informal to formal and in many cases constitute the highlights of the telephone social "season." In some locations groups of employees assemble at regular intervals to listen to recorded music or to participate in "sings."

Outstanding in the social field is the activity of the Telephone Pioneers of America. Although this organization of long-service people in the telephone industry now has many interests beyond the merely social, its many hundreds of dinners and parties in all parts of the country are eagerly-awaited and attended by members and guests.

And possibly coming under the head of "social" activities, and surely deserving of mention here, are the many generous instances of toys, dolls, clothing, and other gifts collected by employees as the Christmas season approaches and distributed to families and individuals who might otherwise lack entirely the presents which are traditionally the manifestation of the Yuletide spirit.

Cultural Activities

THE TERM "cultural" is used in a broad sense to include activities having to do with the arts and crafts and with many "marginal" interests which make for a more fully rounded life and more satisfying self expression. In this group are the choral societies and glee clubs, orchestras, and music and dramatic clubs. These organiza-

Choral societies offer training, practice, and pleasant social contacts

Dressmaking classes are popular

tions, many of which make public appearances, offer training and practice as well as pleasant social contacts. There have been interesting instances of inter-company group performances in this field, and also in connection with photographic exhibits.

Under this general heading also come painting and sketching, poster making, ceramics, sewing, tailoring, knitting, and millinery designing. Many of these interests are "productive" as well as cultural, and the resultant products have practical uses, especially those which can be used in the home or can be worn.

Educational activities include public speaking courses, forums for discussion of current events, book clubs, study clubs, movie clubs, and language classes.

During the war, Bell System garden groups promoted victory vegetable gardens. Today, although the emphasis has shifted to a balance between flowers and vegetables, the knacks learned in wartime have not been forgotten. Gardening naturally suggests harvest and flower shows, at which employees may exhibit the fruits of their toils.

Mention of the various hobby enterprises has been reserved until this point in order to give special emphasis to their value to Bell system men and women. Whether the interest be still or motion picture photography, stamp or coin collecting, amateur radio, furniture building, antique collecting, rug making, or whatever else a person desires to engage in, hobbies are contributing in no small measure to the out-of-hour enjoyment of Bell System people. And they are doing more than just that—they are aiding active employees to gain interests and skills which will be carried over into retirement. Thus they will help bridge the gap between the telephone job and the days of leisure which are ahead and will, in some cases, prove profitable.

The idea of taking up a hobby is one which results most often from "exposure" to the productions or collections of those who are already interested. So the holding of hobby shows not only provides exihibts of absorbing interest but proves to be a means of bringing many non-hobbyists into contact with the results of the activity. The Telephone Pioneers organization is especially active in this field and in some cases is extending

Telephone men and women participate in various athletic activities throughout the year. The enjoyment of bowling and volley ball is not dependent on the weather; softball recruits plenty of material for the summer league games

Art study groups provide opportunity for self development

the hobby influence by setting up traveling hobby exhibits and by making available "hobby counselors."

Who are the Interested Employees?

EMPLOYEES who feel the desire for informal activity not directly related to their daily work and who find an answer to this need in out-of-hour recreational activities are everywhere in the telephone organization. If you examine a list of exhibitors in a harvest or hobby show, or the membership list in a camera club, glee club, bowling league, or almost any other recreational program, you will find the names of people in practically all the occupations which together form the team that is the Bell System.

It is entirely normal for people to want to express themselves through activities of the kind such recreational programs provide. Since employees are with their fellow-employees such a large part of their waking hours, it is a natural consequence that these fellow-workers are the ones with whom they join in at least a part of their off-hour recreational activities. What do employees gain from these activities? Their answers to this question would include such things as better health, added knowledge, broader outlook, increased acquaintance, happier frame of mind, and, in general, richer lives.

How the Activities Become Organized

THE PUBLICITY given employee recreational programs varies in each company. Information concerning the purposes of the clubs, associations, and other groups administering the activities is contained in bulletin board posters, questionaires circulated for the purpose of developing interest, mimeographed announcements—either periodical or occasional; in club, association, or group publications, and articles in company magazines. One of the most effective sources of publicity is the verbal boosting given by the telephone people who take an active part in the activities. And of course "exposure"

of non-participants to any of these activities may gain adherents.

In general, two ways are open in the handling of employee recreational work. One is to have a company recreational staff which directs all activities, possibly using employees on committees under staff supervision. This plan is simple and direct in operation, but it is restricted in the spread of interest and participation by employees.

The other plan, and the one used generally throughout the Bell System, is to invest the employees with the responsibility for originating and promoting the various activities, heading committees, and supervising operation. In this type of organization there is also a recreational staff, but it remains in the background, acting in an advisory capacity and assisting with detail work. This latter method of operation has proved most satisfactory; it creates much more interest, results in many more employees being engaged in the activities, and gives employees authority and prestige in the recreational program.

Because there are so many different recreational activities, and because interests of employees vary considerably among areas and companies, it follows that administration of the activities does not adhere to any set pattern. In most of the operating companies, the development of the recreational program generally depends upon the sizes and types and locations of the various employee groups. The programs are administered in a number of different ways, to suit the needs of the individual case, with such coöperation by the company as is indicated to meet the employees' interests and desires for recreational activities.

Where facilities are available, the companies in general provide space, heat, and light for meetings, out-of-hour classes, and social gatherings.

Public speaking classes provide many telephone employees with opportunity to learn about the techniques of self expression

Chess may relax the body but it stimulates mental concentration

In a few cases the companies have recreational facilities which are available for use by the active groups; but for the most part private, commercial, and public facilities are used for athletic activities, and where charges are made for such facilities the cost is paid by the employees participating.

In locations where large numbers of employees are concentrated, such as in the case of a manufacturing plant or general headquarters staff organization, there are well-developed and extensive recreational programs administered by organized employee clubs or other such groups. Following is a description of one employee club which is typical of such an arrangement:

"This club administers the entire social and recreational program at the plant and provides those seeking further education with opportunities in that direction. All employees at the plant are automatically members of the club, but the privilege of voting and holding office is restricted to those who have been in continuous service of the Company for at least one year.

"Administrative control is vested in a board of directors and executive officers, the latter being responsible to the board of directors for the conduct of the club's business. Directors are elected at annual elections and represent various units of the plant on a proportional basis. Each director is assigned certain responsibilities by the president of the club and appoints committee chairmen who are functional for his several activities. All the executive officers except the executive vice-president serve for a term of one year. The executive vice-president is appointed by the board of directors and serves until replaced. He and his staff of four supervisors manage the affairs of the club on a full-time basis.

Many of the employee recreational groups in the Bell System furnish information about their organization and activities in booklets such as these

"Club activities are supported through fees from members who participate in certain activities, the sale of tickets to social and athletic affairs, plus any profits which may accrue from the club stores. The company provides office staff personnel, playground facilities and rooms for recreational purposes, and makes contributions to defray the expense of approved activities which cannot be cared for with the income anticipated from the sources mentioned."

THIS ACCOUNT has described rather briefly the out-of-hour recreational activities in which telephone employees participate. These activities are many and varied, and appeal to women and men of all age groups. The old saying that all work and no play makes Jack a dull boy has been interpreted by telephone employees to mean that a change of pace from work to play provides a balance and a perspective which makes all of life more enjoyable, more interesting.

The Biggest Vehicular Fleet in the World Includes Not Only Various Sizes of Trucks but Many Kinds of Apparatus Which Contribute to Bell System Efficiency

Keeping Our Automotive Equipment Modern

Temple C. Smith

LIKE A GIANT BEETLE, a train of mammoth machinery crawls across a field on the route between Baltimore and Washington. In its wake it leaves a narrow slot in the ground, from 30 to 60 inches deep, with a thread of silver gray at the bottom.

The time is early 1947. The event is the first appearance in the field of the C–60 cable plow—the largest outside plant tool ever developed in the Bell System—as it splits the ground and deposits a run of coaxial cable safely in mother earth.

The new plow is really huge: 32 feet long, 12 feet high, nine feet wide. It weighs about 23 tons exclusive of its 4-ton control trailer, and is hauled along by 20-ton caterpillar tractors with a pull of about 15 tons apiece. At that, this behemoth's new design gives it an easier response to tractive effort than lighter plows of earlier design.

The train also includes a cable reel trailer, other tractors for changing reels, and the indispensible control trailer.

The control trailer follows immediately behind the plow. From it are operated by remote control the hydraulic rams which move the plow share up and down to produce the desired depth of cut and which also swing it to change the angle of the cutting edge to meet different ground conditions. This also permits rooting out the slot and placing the cable in it at uniform depth even over undulating ground—an important new feature, first introduced in this plow.

Hydraulic power with a force of upwards of 50 tons is also available for rooting out boulders and stumps which obstruct the route. In this fashion the operator can "chew" through a particularly tough stretch of terrain in a series of sweeps of the plow share. Ten-ton pebbles have been rooted out of the way by C–60.

Above: C-60 plow burying coaxial cable three feet deep. Left: Plow in traveling position, with share out of ground at rear

The new C-60 cable-laying plow, with its necessary adjuncts of tractors, control trailer, and cable trailer and cable, is an impressive sight as it cuts its way through the countryside

An important feature of the hydraulic control is a relief valve which "blows" like a circuit-breaker when the blade comes up against an immovable object, such as a ledge. This prevents damage to the plow or tractors from too much strain. The first pass with the plow explores the unknown subsoil condition and locates obstructions, which are removed before the cable is fed into the ground during the second pass.

The final trailer-section of the plow train carries a reel of cable, which is fed through the plowshare into the trench. The average amount of cable carried on one of these reels is approximately 1,000 feet—a trailer-cargo of about 8,500 pounds.

The plow requires relatively little turn-around space and its excellent axle clearance, provided by two 21:00 × 28 rear wheels, practically eliminates trouble from boulders, accumulations of sod, corn stalks, and brush lodging under the plow.

Make-up of the Fleet

THE C–60 PLOW—"Mickey Mouse" to its intimates—is one of the newest additions to the Bell System's automotive fleet of more than 30,000 vehicles and items of equipment—the largest fleet of trucks and cars in the world. Included in the roster are not only trucks and passenger cars but trailers, various kinds of wire plows, pole-hole diggers, pole derricks, platform ladders, tractors, bulldozers, trenching machines, and other miscellaneous types of vehicles,

A Bell System construction truck with the newly designed crew compartment behind the cab

all of which have an important part in providing telephone service.

The fleet had its beginnings nearly 40 years ago, when a few vehicles were put in service in competition with horse-drawn wagons. It has grown steadily in size and efficiency since then, and today the Bell System has no fewer than 16 types of trucks, each designed for a specific task.

More than 60 percent of the over 30,000 vehicles are half-ton trucks, of which the installation type is representative. More than a fifth of the total are passenger cars. The rest range in size from three-quarters of a ton up to trucks of 32,000-pound gross vehicle weight, and correspondingly large tractor trailers.

Not only the number of vehicles but the specialized nature of much telephone work make it natural that Bell System engineers should concern themselves with adapting and improving the various units: creating better tools to do a better job. Several new designs in the automotive field have been developed and adopted recently —some of which are described here. They are doubly effective because they are in time to be included in the large program of replacement of motor vehicles which have served valiantly through the war—thanks to special maintenance practices—but have earned their retirement. Gradually the new fleet will assume an even higher level of appearance, usefulness, performance.

Two views of the crew compartment. It provides ample room (left) for men wearing heavy clothing in winter, and (right) carries a collapsible table which is convenient for making out reports and other uses

The Engineers' Objectives

NEARLY ALL of the vehicles, except the passenger cars, are equipped with special bodies and auxiliary equipment which adapt them to special needs. In designing these vehicles and the apparatus used with them, the engineers give particular attention to these principal objectives:

1. To make every detail of the finished unit as convenient as possible for the men who will use it.
2. To make each unit do its job as efficiently as possible.
3. To incorporate in the design as many of the details from commercially available parts, or parts already developed for other units, as practicable.
4. To build safety into the design and into all uses of the equipment.
5. To meet all legal and regulatory requirements.
6. To provide a unit which will perform reliably with a minimum of time out of service for repairs.
7. To design a unit so it can be manufactured by existing supply sources without using special materials or developing new or special manufacturing equipment.
8. To design it to operate at a reasonable cost.

Comfort En Route

OCCASIONALLY a new service arises which cannot be cared for adequately by an existing unit of equipment.

The crew compartment for construction trucks is one example. Two years ago it was learned that five- and six-man cabs would no longer

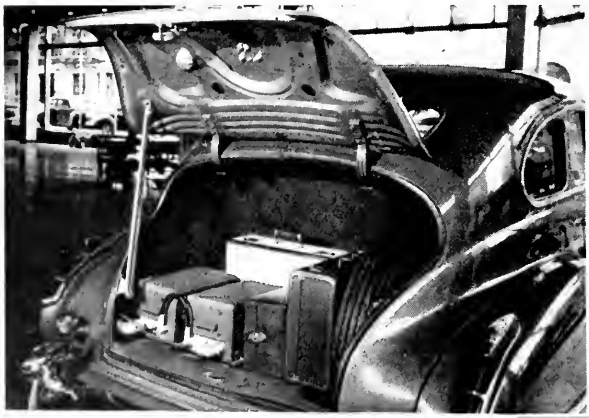
Interior arrangements in the recently developed installation truck body. With certain modification, this same body is used for a repeater-station service truck

be commercially available in sufficient quantities to meet the System's large requirements. Besides being extremely difficult to obtain, many of them were too cramped, lacked desirable features, and in some instances cost nearly as much as the entire body.

The engineers went to work, and came up with a three-man compartment located just behind the regular two- or three-man cab. The compartment has its own doors and windows and is connected with the front cab by a bellows, with a large window opening between the two seating spaces.

Many improvements were made with the comfort of the truck's crew in mind. The new compartment is insulated against the heat of summer and the cold of winter and can be uniformly heated when necessary. It is equipped with foam latex cushions, a collapsible desk or lunch table, and spaces for storage of lunch boxes. It has several advantages over the former cab design, including doors 60 inches high instead of the standard 45 inches. When manufactured in quantity, the compartment compares favorably in cost with its predecessors.

In developing a complete construction truck body, engineers first determine the maximum numbers and types of materials and tools to be carried. Most of the telephone construction trucks today are equipped to carry about 200 kinds and sizes of materials and 70 kinds of tools. These must be located according to their use, and conveniently accessible.



Above: The two mobile telephone units mounted at the left in the baggage compartment of a passenger automobile do not block access to the spare tire, and leave space for luggage

Below: New design of radio telephone cabinet for mounting on a truck cab

The new aluminum-alloy truck platform ladder is now being produced in quantity. The large picture illustrates how it may be extended over a parked car or a roadside ditch, while the insert shows the ladder lowered and made secure for traveling

Sometimes truck bodies designed for one task are only slightly modified for another particular use. Recently there arose a need for a half-ton or three-quarter-ton truck specially equipped for servicing isolated, unattended telephone repeater stations. The engineers started with the body shell of an installation truck, omitted the ladder brackets, and added two doors on the left side. While the outside appearance of the maintenance truck remained virtually the same as the installation truck, the interior space was rearranged to carry a large supply of water for replenishing telephone storage batteries, and to provide space for delicate instruments, including vacuum tubes.

Radio Enters the Scene

THROUGHOUT the entire series of 16 telephone truck bodies, the same materials and design methods are used as far as practicable. All truck doors, for example, are made alike, with locks identical except for keying. All body corners and frames are also of similar design. This eases the material stock situation with the manufacturers and keeps to a minimum their required number of tools, jigs, dies and patterns.

Body design from now on must take into consideration additional space for telephone equipment. The rather sudden advent of mobile telephone service just a year ago has posed difficult problems for the automotive equipment designers because of lack of adequate space for the new apparatus. In some instances, the radio equipment is installed in weather-proof boxes atop the truck driver's cab; in passenger cars, it is usually located in the trunk compartment.

In addition to mobile telephone equipment (which is not yet universal

Tip platform trailer. As machinery is run up the skid to platform level the front end drops slowly forward to the horizontal, where it is locked for travel

in the fleet), Bell System trucks carry a variety of special equipment which requires individual adaptations and designing for each type.

A new series of winches, for installation on telephone trucks, has been developed in several sizes for various applications, such as with derricks for handling poles and light earth borers, and for pulling cable. Automatic brakes are incorporated in all, and automatic winch-rope winders are being tested for incorporation as standard parts.

The entire line of telephone pole derricks has undergone recent improvement. A survey has indicated a preference for the "T-type" of derrick, which has a telescoping boom adjustable both in length and in overhang.

One of the most recent additions to the Bell System's fleet is a new aluminum platform ladder for trucks. Like its wooden predecessor, it is completely out of the way while in traveling position, but it is taller and more rugged and has an adjustable overhang. A lineman can even inspect an aerial cable with the ladder extending over a car parked at the curb, or over a narrow ditch at the side of the road.

Pole, cable reel, and splicer's trailers for highway use have changed in recent years only by improving details. But a new kind of trailer, the tip-platform type, is now being developed for carrying heavy equipment, such as trenching machines. The platform is hinged so it can be lowered at the rear to become a skid. The machinery is run up to platform level, the front end becomes heavy,

Large pneumatic tires fore and aft replace the usual caterpillar tracks on this winch-loading cable-reel trailer

For cross-country work where use of the plow is not feasible, the trenching machine shown above will lay cable to a depth of 42 inches. The lighter machine at the left is particularly useful for trenching in cities, where sidewalks and service pipes prohibit use of plows

and, in settling to the horizontal, raises the skids to platform level. Hydraulic shock absorbers prevent a quick drop in either direction and there is, of course, a substantial lock to hold the platform horizontal when traveling.

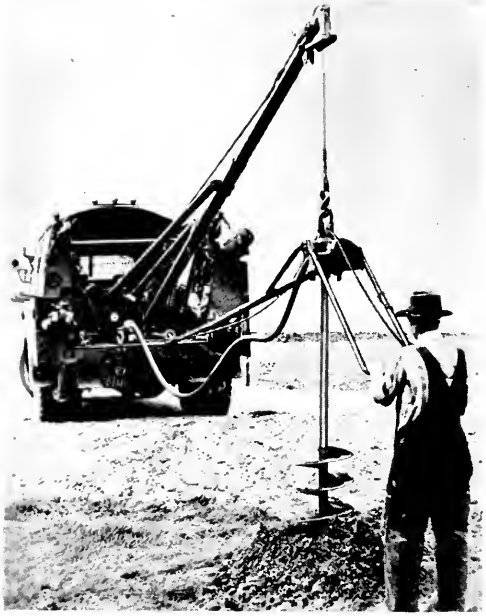
Among off-the-road trailers, the winch-loading cable reel trailer has been improved by substituting large tandem pneumatic tires for the usual caterpillar tracks. This design results in less trouble from accumulating mud and from freezing up in winter, and enables the trailer to move faster on the highways. This pneumatic-tire bogey also costs less to build and maintain and it lasts longer than its predecessor.

A larger diesel-powered tractor has recently become available, providing more traction and more pulling power than previous models. Its new hydraulic-torque-converter drive is automatic, eliminating jerky starts and permitting synchronization with other tractors in a plow train. The work of adapting these new type tractors to the plow train is now under way.

Trenchers, Augers, and Rodders

In the final development stages are two new types of trenching machines for burying cable, which are expected to meet telephone construction requirements. One type will be used to place cable at relatively shallow depths in order to avoid gas and water pipes in urban areas, handle a minimum amount of earth in excavating, and lay the cable so it will be protected by the sidewalk. Light weight and low cost of the machine for this work are more important than the speed of operation.

The second type of trenching machine will be used for cross-country work. It will be faster and will lay the cable as it digs—a procedure not



This light portable auger, suspended from the truck pole derrick and operated through a flexible shaft from its own small engine, is one of several types of earth-boring machines recently developed

feasible in cities because of crosswalks and streets.

Relatively new in the Bell System's group of earth-boring machines is a new portable pole-hole digger. When operated on a truck, the unit consists of an earth auger driven by a small air-cooled gasoline engine through a flexible shaft and raised and lowered by the truck winch and derrick. Due to its lightness and flexibility of operating positions, this digger can be used on light trucks, being adapted to any truck equipped with winch and derrick but best suited to operating with the T-type derrick. It can be changed from one truck to another in a few minutes.

Heavier earth-borers are used where very difficult soil conditions make it impracticable to use the lighter digger. For operation in places inaccessible to trucks, such as swamps, medium- and heavy-duty borers have been mounted on caterpillar tractors. However, the lack of traveling speed and the fact that usually the caterpillars are not permitted on pavements limit their use in pole setting to large jobs of continuous new pole lines.

Telephone cables beneath city streets are generally run between man-holes through ducts made usually of vitrified clay, sometimes of other materials. So much underground cable is now being placed that the application of mechanical energy to the jobs of cleaning and rodding ducts takes on added importance. Two ways to apply power have been developed.

With one method, four-foot metal rods are joined and pushed forward

through the ducts by hand at the same time that they receive a twisting motion from a small engine. When pushed direct, they can be moved ahead only 300 to 400 feet; with the added twisting action imparted by the motor, that distance can be increased by from 50 to 100 percent.

The other method employs a truck-mounted machine which thrusts and twists a continuous flexible spring-steel rod into the duct. The ratio between thrusting and twisting can be varied to meet different conditions; the machine has been found to be effective up to distances of 1000 feet; it will withdraw the rod from the duct as well as drive it forward.

THE BELL SYSTEM'S present great plant construction program obviously puts special emphasis on all mechanical devices which will save time and promote efficiency. To these, the System's fleet of motor vehicles and construction apparatus contributes immeasurably. The engineers who design, adapt, test, refine, and perfect the several types of units here described thus have no small share in achieving the nationwide objective of providing service for all those who are waiting for telephones and of expanding the System's facilities to meet present and anticipate future requirements.

THE HUMAN BODY is supposed to change every seven years. But while at the end of that time it is practically a new body, there was no particular day on which it became a new model. Telephone plant is renewed by a similar evolutionary process. In the average household where a telephone has been for ten years it provides a better service from what it did to begin with, but at no time was the whole connection between the telephone and the central office taken out and a new one put in. At one time cable may have been substituted for open wire for part of the distance. At another time the instrument may have been changed. At another time the transmission characteristics of the line changed. At another the switchboard changed to dial. When all this has been done perhaps nothing but the wires into the house itself remain the same. Yet at no time was the service interrupted. This process means that improved apparatus must be so designed as to work with all existing apparatus and be introduced into the plant piecemeal so that improvement is an evolutionary process.

From "The Bell Telephone System," by Arthur W. Page, Vice President, A. T. & T. Co. Harper & Brothers, publishers, 1941.

Mark Twain and the Telephone

Publication during the past year of two collections of Mark Twain's writings * serves as a reminder that he was an early user of the telephone—not only as a means of communication but as source material for his ready pen. The files of the American Telephone Historical Library yield the material on which the following account is based. THE EDITORS

IN THE American Telephone Historical Library, on the twenty-sixth floor of the A. T. & T. building in New York City, is filed an original copy of *The Hartford Telephone Directory,* published under date of June 1, 1879, by The District Telephone and Automatic Signal Company, whose office was at 240 Main Street, Hartford, Conn. Among the names listed as subscribers for residence telephones is the following entry:

Clemens, Samuel L., 95 Farmington Ave.

The entry throws little light on the question of who was the first telephone humorist, which will probably never be settled—for telephone jokes are almost as old as the telephone itself. But it does present at least presumptive evidence that Mark Twain was among the first American humorists who took the telephone seriously enough to pay the required rental for the use of the newly introduced device. The annual rental, by the way, according to another page of the Directory, was "$22.00 a year in advance"—a sum which, considering what you got for it, was no laughing matter back in 1879, even for a humorist.

That Samuel L. Clemens was a pioneer among humorists in using the telephone is thus established. There is no evidence, moreover, that he was antedated on the roster of American telephone subscribers by others in the field of literature whose names were equally well known. He seems to have had a penchant for experimenting with new inventions. It is well established that he was among the first of American authors to turn out his manuscript on a typewriter. So, also, was he a trail blazer in the matter of becoming a addict to the telephone. Which does not at all mean that he did not see its humorous possibilities.

ANOTHER interesting item in the American Telephone Historical Library is a manuscript bearing the title *Recollections of the First Telephone Installations in Hartford, Connecticut, 1877–78–79,* by John Malcolm Knox. In it Mr. Knox recounts that "a line was built from the *Hartford Courant* establishment to the homes of two of its editors and proprietors—General Joseph R. Hawley and Stephen Hubbard—and thence to Mark Twain's residence. I was sent out to assist two linemen.

* MARK TWAIN: BUSINESSMAN; edited by Samuel Charles Webster; Little, Brown & Co., Boston. THE PORTABLE MARK TWAIN; edited by Bernard de Voto; Viking Press, New York.

Crane, William R.,	. .	887 Asylum.
Covey, W. E.,	. .	16 Garden.
Chase, George L.,	. .	888 Garden.
→ Clemens, Samuel L.,	. .	95 Farmington Ave.
Christesen, R.,	. .	20 Chapel.
Cushman, A. F.,	. .	141 Sigourney.
Davis, J. B.,	. .	183 High.

Reproduction of part of a column from the Hartford telephone directory issued on June 1, 1879. Subscribers were called by name then, and not by number

They were installing the telephone in Hawley's house when I came on the scene. On our way to Twain's I can remember going through skylights, clambering over roofs, and climbing trees, poles being used only when necessary. There was some confusion when we attempted to install the telephone in his home."

The author here adds, parenthetically, that "the confusing thing about a humorist is that one never knows when he is fooling." He continues:

"While the work was in progress, he strode about the room and uttered something like the following—

" 'The voice carries entirely too far as it is. If Bell had invented a muffler or gag he would have done a real service.'

" 'What's the idea of attaching a long-distance feature to anybody's voice? He's crazy!'

" 'Put the thing near the window, so I can get rid of it easily.'

" 'Here we have been hollering "Shut up!" to our neighbors for centuries, and now you fellows come along and seek to complicate matters.'

" 'I must be an easy mark to exchange dollars for dubiousness.' "

This report of the humorist's offhand remarks sounds authoritative—that alliterative phrase as to "dollars for dubiousness" smacks of the real Mark Twain. One wonders whether the two telephone installers and their assistant really appreciated the fact that they were getting, for nothing, what publishers were falling over themselves to pay for in good coin of the realm.

PERHAPS one of the earliest of published humorous articles about the habits of telephone users, "A Telephonic Conversation," was written by Mark Twain and published in the *Atlantic Monthly* for June, 1880—just a year after the name of Samuel L. Clemens appeared in the Hartford Telephone Directory. Since the charm of Mark Twain's description of this one-sided telephone conversation lies in large measure in the length of time the exchange of small-talk continued, it is for that very reason unprofitable to quote it here. But Mark Twain had made the profitable discovery that there is something essentially intriguing about a conversation of which the listener is able to hear only one side.

"*A Connecticut Yankee*"

ONE OF THE best known of Mark Twain's full-length books was "A Connecticut Yankee in King Arthur's Court." Although it was first published in 1889, it bears internal evidence that the author may have begun

work on it ten years earlier. If the book may properly be associated with a date not longer than three years after the first transmission of speech by telephone, Mark Twain's references in it to things telephonic become the more remarkable.

The humor of the book, it will be recalled, lies in the fact that when the Connecticut Yankee was miraculously transported back into the court at Camelot, he took his modern civilization with him—including the telephone. Thus, in Chapter X, the fictitious chronicle declares:

> We had another large departure on hand, too. This was a telegraph and a telephone; our first venture in this line. These wires were for private service only, as yet, and must be kept private until a riper day should come. We had a gang of men on the road, working mainly at night. They were stringing ground wires; we were afraid to put up poles, for they would attract too much inquiry. Ground-wires were good enough, for they were protected by an insulation of my own invention which was perfect.*

By a sweep of his facile pen, Mark Twain had thus easily solved a problem which it took Bell System engineers many years to answer. Small wonder that, by Chapter XXLV, the Yankee was able to put through a long distance call, and to comment on it thus.

> It sounded good! In this atmosphere of telephones and lightning communications with distant regions, I was breathing the breath of life again after long suffocation. I realized, then, what a creepy, dull, inanimate horror this land had been to me all these years, and how I had been in such a stifled condition of mind as to have grown used to it almost beyond the power to notice it.

* By courtesy of Harper Bros., publishers.

Romance there is, too, in Mark Twain's story of the Yankee's strange adventures. His chance meeting with the Demoiselle Alisande la Carteloise, whom the hero grew to know so well that he called her "Sandy" for short, are duly recounted—including the fact that they eventually fell in love and were married. The union was blessed with a small daughter named —well, as to the name, let us refer to the text itself:

> In my dreams, along at first, I still wandered thirteen centuries away, and my unsatisfied spirit went calling and harking all up and down the unreplying vacancies of a vanished world. Many a time Sandy heard that imploring cry come from my lips in my sleep. With a grand magnanimity she saddled that cry of mine upon our child, conceiving it to be the name of some lost darling of mine. It touched me to tears, and it also nearly knocked me off my feet, too, when she smiled up in my face for an earned reward, and played her quaint and pretty surprise upon me:
>
> "The name of one who was dear to thee is here preserved, here made holy, and the music of it will abide always in your ears. Now thou'lt kiss me, as knowing the name I have given the child."
>
> But I didn't know, all the same. I hadn't an idea in the world; but it would have been cruel to confess it and spoil her pretty game; so I never let on, but said:
>
> "Yes, I know, sweetheart—how dear and good you are, too! But I want to hear these lips of yours, which are also mine, utter it first—then its music will be perfect."
>
> Pleased to the marrow, she murmured:
>
> "HELLO-CENTRAL!"
>
> I didn't laugh—I am always thankful for that—but the strain ruptured every cartilage in me, and for weeks afterward I could hear my bones clack when I walked. She never found out her mis-

take. The first time she heard that form of salute used at the telephone she was surprised, and not pleased; but I told her that I had given order for it; that henceforth and forever the telephone must always be invoked with that reverent formality, in perpetual honor and remembrance of my lost friend and her small namesake. This was not true. But it answered.

A Telephone Romance

EVEN GREATER distinction awaited the telephone at the hands of the imaginative Mark Twain. In one of his stories, less well known than many but written with that tongue-in-cheek seriousness that was characteristic of some of the best pieces of writing he did, he made the telephone the central figure of the plot—and plot there was!

The tale solemnly parodied the rather saccharine romances of the period. It was originally published in a volume of stories which took its name from the first of the series, *The Stolen White Elephant,* and appeared in 1894. The name of the tale was in keeping with the manner in which it was told. It was "The Loves of Alonzo Fitz Clarence and Rosannah Ethelton."

If the story had a hero, that hero was distinctly the telephone. It was by telephone that Alonzo, in Eastport, Maine, and Rosannah, in San Francisco, were formally introduced; by telephone that their courtship was conducted; by telephone that, across the expanse of a continent, they plighted their troth, whispering soft nothings into each other's ears, as young people in love are wont to do, even without benefit of Bell's invention. And it was by telephone that the villain sought to see that the course of true love did not run smooth.

Rosannah, in fact, fled to Honolulu, in the hope that a change of scene might serve somewhat to assuage the wounds which her spirit had suffered. It all looked pretty hopeless, though, until—but the telephone came to the rescue, and the happy lovers were reunited—and were married by long distance, which fortunate outcome of the tale is attested by purported copies of articles in the Honolulu and New York papers, giving the details of the two widely separated ceremonies.

From all of which it would appear that Mark Twain was something of a prophet, as well as a spinner of entertaining tales. It was not until a score of years after the publication of this romance of a transcontinental courtship that the first New York-San Francisco telephone line was built. And as for the New York-Hawaii conversation—that must have seemed to his readers the very acme of ridiculousness, as they turned Mark Twain's pages back in 1894. But on December 23, 1931, radio telephone service was opened to the public between the United States and Hawaii.

Crossed Wireless

(From the New York *Sun*. Reprinted by permission.)

LONDON, March 27, 1947 (A.P.).—The day may be near, a leading psychic researcher said today, when you can pick up a telephone and call the dead in the spirit world.

The spirits of Alexander Graham Bell and Guglielmo Marconi have been telling him how, said John J. Williamson, founder and past president of the Society of Metaphysicians, Ltd.

Williamson, who gets his information through living mediums now, said Bell and Marconi seem tremendously excited about the idea and have poured across some 100,000 words of technical data. They first told him and his research associates to use atom-smashing machinery for mechanical communication with the other world, he said, but the cost seemed prohibitive. A cyclotron, even second hand, costs many, many thousand of pounds.

So Williamson began research at the society's research center, a big, hotel-like building in Hastings, Sussex, and developed what he called "far simpler" mechanical methods.

"If we can succeed in perfecting the simpler methods," he said, "there is no reason why any one cannot have a 'spirit telephone' costing no more than five pounds ($20)." That, said Williamson, would revolutionize the seance.

His news, reported in Society literature, caused wide comment among Britain's spiritualists who, according to psychic societies, number about 30 percent of the whole population. A good many agreed with Williamson's thesis that human mediums can't really be depended upon. Most of them unintentionally garble messages from the other world, the spiritualists say.

Williamson's research is backed by the Society, which has membership in many walks of life.

(From "Exploring Life," the Autobiography of Thomas A. Watson. D. Appleton, 1926.)

ONE DAY [in 1876] Mr. Hubbard received a letter from a man who wrote that he could put him on the track of a secret that would enable us to talk any distance without a wire. This interested Mr. Hubbard and he made an appointment for the man to meet me at the laboratory.

At the appointed time a stout, unkempt man made his appearance. He glanced at the telephones lying around the benches but didn't take the least interest in them. He told me the telephone was already a back number and if we would hire him he would show us how to telephone any distance without apparatus or wires. He looked as sane as most of the inventors I had worked with and I became interested.

When I asked him what experiments he had made, he told me in a matter-of-fact tone that two prominent New York men, whose names he knew but whom he had never seen, had managed surreptitiously to get his brain so connected with their circuit that they could talk with him at any hour of the day or night wherever he was and make all sorts of fiendish suggestions—even of murder. He didn't know just how they did it but their whole apparatus was inside his head and if I wanted to find out their secret I must take off the top of his skull and study the mechanism at work. For fifteen dollars a week, he said he would place himself entirely at my service to do whatever I pleased with him.

Long before he finished his tale, I knew I was dealing with a crazy man. I didn't dare to turn down his proposition too abruptly for fear he might go on a rampage in that lonely attic so I excused myself from starting to dissect him at once on the ground of a pressing engagement and he went away promising to come again the next day. He didn't come and the next time I heard of him he was in an asylum.

Twenty-five Years Ago in the

Bell Telephone Quarterly

Items from Volume I, Number 2, July 1922

Sleet Storms

The restoration of the Bell telephone service after the several storms of last winter was in each case effected with reasonable promptness. The fine spirit of the employees was everywhere evinced and some idea of the quantity of materials which the Western Electric Company was called upon to deliver this winter on emergency shipments may be had by reference to the following list of a few principal items ordered following the storms in New England in November, and in Michigan and Wisconsin in February:

10,000	poles
20,000	crossarms
42,000,000	feet of bare copper wire
8,000,000	feet of covered wire
420,000	glass insulators

The assembly and shipment of these major items together with much miscellaneous material was entirely completed in nine days in each case, more than 50 percent. of the whole being shipped in the first three days. . . .

Of the total storm destruction mentioned, the New England Bell Telephone Companies suffered to the extent of more than one and a half millions of dollars. The damage to the Long Lines Department of the American Telephone and Telegraph Company was nearly one million dollars. The damages to the Wisconsin Telephone Company and Michigan State Telephone Company were approximately two millions of dollars. The Northwestern Bell Telephone Company had over nine hundred thousand dollars of plant destroyed, and The Pacific Telephone and Telegraph Company about six hundred thousand dollars. Not a single Bell Telephone Company in the country escaped. This storm damage is recognized as a part of the cost of furnishing telephone service. Some years it is heavier than others, but it is always a factor.

—From an article by Allen B. Crunden, then general supervisor of accounting methods, American Telephone & Telegraph Company. He subsequently became assistant comptroller, and retired in 1943.

Experimental Broadcasting Station

Our new broadcasting station at No. 24 Walker Street, New York City, is completed and ready for service. The Department of Commerce has refused us a special wave length of 400 meters and we have been assigned the common wave length of 360 meters. This means that we must operate in common with fourteen other broadcasting stations in this zone. The stations which are now operating are using all of the available time and we are now negotiating in an endeavor to obtain suitable hours during which we may begin operations. In order to start in an experimental way and more in the nature of a demonstration of what we can do, we have requested that we be assigned the hours of 11:00 to 12:00 A.M.; 4:30 to 5:30 P.M. each week day, and Thursday evening from 7:30 P.M. to midnight. It

is expected that we will receive this assignment in the very near future, and we will then start negotiations with our prospective users of the facilities. Already, without any soliciting or canvassing, approximately one hundred persons have made application.

From "Notes on Recent Occurrences."

STANDARD FEATURES were "Technical Papers published during the Quarter Just Ended," and "Notes on Recent Occurrences." In the latter section of the QUARTERLY were an account of a ship-to-shore radio demonstration at Harrisburg; reports of the use of the Bell System's newly developed loud speaker system at a number of public occasions; comments on the new radio law and radio regulations; an analysis of subscribers to the preferred stock of the Wisconsin Telephone Company; an announcement of the forthcoming *"Bell System Technical Journal;"* and a statement that Theodore N. Vail had been selected by the Old Time Telegraphers as the first among five men who had done the most for the commercial development of the telegraph.

TRAMPING lower Broadway, studying signs of many kinds, I had come to believe that the best color scheme for such a sign would be blue on white, with plenty of blue. Alone in my office with the samples at hand, I took a large pad of paper and tried to study the question from the bottom up. We wanted a sign for Alexander Graham Bell's telephone. With that as the fundamental I sketched on the paper the outline of a bell. To the next question, "What kind of telephone are we to advertise?" there was but one answer, the long distance telephone. And so I printed within the outline of the bell the words "Long Distance Telephone." This looked good to me and, deciding to follow the color scheme described, I had a blueprint made from the drawing and discussed it with my associates. They liked it. The original sketch and blueprint were approved by Edward J. Hall, Jr., general manager of the company, my superior officer, on January 5, 1889, together with the words "Standard Bell, use no other form." So was born the Blue Bell of the telephone.

From "Hello-Goodbye," autobiography of the late Angus Hibbard, first general superintendent of the A. T. & T. Company

Who's Who & What's What *in This Issue*

A STATEMENT of the Bell System career of President WALTER S. GIFFORD was given in the Spring issue of this MAGAZINE, in which was published his tribute to Alexander Graham Bell on the occasion of the latter's centennial.

"WHY DO YOU have to teach people how to use the telephone?" is a question with which telephone people are almost as familiar as the perennial "Why does the telephone company have to advertise?" It is to the former that JUSTIN E. HOY provides some illuminating answers. He started to learn them in 1929, when he joined the Southwestern Bell Telephone Company at Parsons, Kans. Successively a salesman of directory advertising, of exchange, toll, and TWX services, sales supervisor, and sales training supervisor, his last assignment with the Southwestern Company was supervising the company's servicing work with large business firms in the Kansas City division. A year ago he transferred to the commercial division of the A. T. & T. Company's O. & E. Department, where he has since been busy in the sales and servicing section on business exchange servicing activities.

STAFF AND FIELD ASSIGNMENTS in the New York Telephone Company's Traffic Department brought JOHN G. SIMMONS experience in manual, dial, information, and toll operation between 1922 and 1945. In the latter year he transferred from his post as General Traffic Supervisor in the Long Island Area to the Personnel Relations Department of the A. T. & T. Company. There he is concerned with personnel matters relating to the General Departments as well as with System recreational activities and thrift plans and with the Telephone Pioneers.

Walter S. Gifford

Justin E. Hoy

John G. Simmons

Temple C. Smith

THE ARTICLE beginning on page 90 is TEMPLE C. SMITH'S seventh contribution to these pages since 1925. All have had to do with plant affairs, and all but the first with motor vehicles. The most recent, "Plowing Cables into the Ground," appeared in the issue for June 1942. Mr. Smith is recognized outside as well as throughout the Bell System as both pioneer and expert in his special field of automotive and construction apparatus designing. He joined the New York Telephone Company in 1910, and since 1921 has been with A. T. & T.

ume XXVI Number Three Autumn 19

B-T

Tele

MAGAZINE

Distribution by Western Electric Company
ALVIN VON AUW

How Big Are the Little Things in the Telephone Business?
KEITH S. MCHUGH

Plastics—Their Growing Use in Telephone Plant
JOHN R. TOWNSEND

Excursion in Engineering • CARROLL O. BICKELHAUPT

Telephones in the World of 1947 • JAMES R. MCGOWAN

Hammond V. Hayes: 1860–1947 • ROGER B. HILL
and THOMAS SHAW

nerican Telephone & Telegraph Company · New York

Bell Telephone *Magazine*

Autumn 1947

Distribution by Western Electric Company, *Alvin von Auw,* 113

How Big Are the Little Things in the Telephone Business? *Keith S. McHugh,* 124

Plastics—Their Growing Use in Telephone Plant, *John R. Townsend,* 127

Excursion in Engineering, *Carroll O. Bickelhaupt,* 136

Telephones in the World of 1947, *James R. McGowan,* 139

"The New Bell Telephone," 149

Hammond V. Hayes: 1860–1947, *Roger B. Hill* and *Thomas Shaw,* 150

Twenty-five Years Ago in the Bell Telephone Quarterly, 174

A Medium of Suggestion & a Record of Progress

Published for the supervisory forces of the Bell System by the Information Department of AMERICAN TELEPHONE AND TELEGRAPH CO., *195 Broadway, New York 7, N. Y.*
WALTER S. GIFFORD, *Pres.;* CARROLL O. BICKELHAUPT, *Sec.;* DONALD R. BELCHER, *Treas.*

Who's Who & What's What *in This Issue*

SINCE his previous appearances in these pages,* ALVIN VON AUW has covered a lot of new territory, most of it by courtesy of the United States Navy. After seeing action as Air Combat Intelligence officer with a night air group in the first carrier raids on the Tokyo area and after surviving the battering his ship, USS Saratoga, took while supporting the operations at Iwo Jima, Mr. von Auw was released from active duty as Lieutenant, USNR, and resumed his post as information supervisor in the Public Relations Division of the Western Electric Company. Since his return, he has written a number of booklets about Western Electric functions for employee and general distribution, and has been active in the company's motion picture program. Before coming to Western Electric in 1939, von Auw served briefly as managing editor of Listeners' Digest.

* See "Western Electric: Telephone Arsenal," MAGAZINE, August 1941; and "Doing a Bigger Job—with Less," MAGAZINE, August 1942.

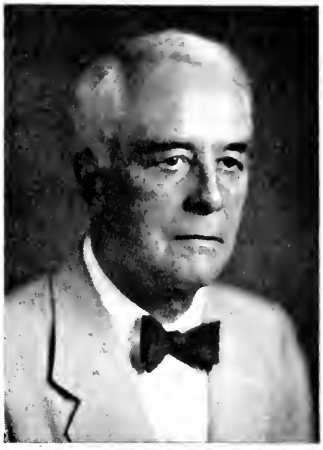
IT WAS as a clerk that Keith S. McHugh joined the A. T. & T. Company in 1919, but within a few months he became an engineer in the O. & E. Department. From 1921 to 1925 he was general commercial engineer of the Chesapeake and Potomac Telephone Company in Washington, D. C., and for the next four years he was with the New York Telephone Company as general commercial manager and as vice president. In 1929 he returned to A. T. & T. as commercial engineer, and was appointed an assistant vice president in 1934. He was elected a vice president in 1938, and in 1946 was placed in charge of the Information Department. He contributed "War Activities of the Bell Telephone System" to this MAGAZINE for November 1942; was one of the authors of "The Bell System's Interest in Program Television" in the issue for Spring 1944; and his farewell to radio broadcasting station WEAF appeared in the Autumn 1946 issue.

Alvin von Auw

Keith S. McHugh

John R. Townsend

Carroll O. Bickelhaupt



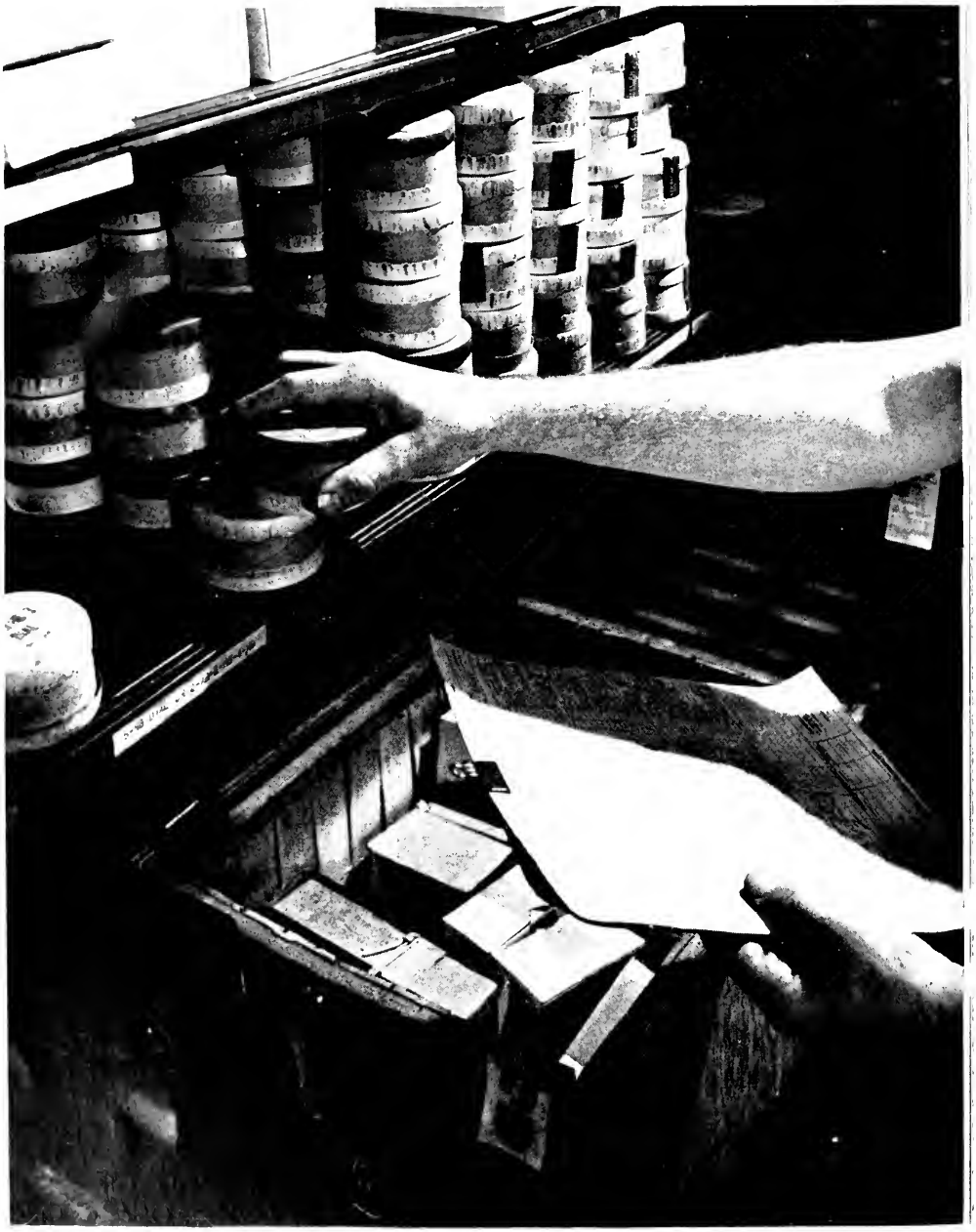
Roger B. Hill

Thomas Shaw

"RESEARCH REVOLUTIONIZES MATERIALS" is the title of one lecture which JOHN R. TOWNSEND has given recently. It might almost serve as title for his contribution to this issue, were it not that he has narrowed his field here a bit to take in only the use of plastics in the telephone business. The title of another lecture, "Materials Engineering at Home and Abroad," is also particularly apt, because Mr. Townsend has been since 1945 materials engineer at the Bell Telephone Laboratories. For 20 years before that he had been materials standards engineer. He joined the Bell System in 1919, after military service in World War I. In World War II he assisted on many technical problems for the Armed Services, the Office of Scientific Research and Development, the War Production Board, and others. In 1945 he spent two months in England, France, and Germany for the Foreign Economic Administration. Mr. Townsend has written and lectured extensively on technical subjects, and is a member of several scientific societies. He was awarded the Dudley Medal in 1930 by the American Society for Testing Materials, and served as president of that organization last year.

THE TWO distinguished careers—civilian and military—of CARROLL O. BICKELHAUPT are linked through the common interest of communication. Joining the A. T. & T. Company in 1911, Mr. Bickelhaupt had served as toll rate engineer, toll traffic engineer, and commercial engineer there before he was elected vice president in charge of operations of the Southern Bell Telephone and Telegraph Company in 1925. Five years later he returned to A. T. & T. as assistant vice president. He was elected vice president in 1941, and secretary of the company in 1945. Meanwhile, through two wars, he had risen in the Signal Corps from first lieutenant in 1916 to brigadier general in 1944. Before Pearl Harbor, he was on active duty as Military Observer abroad, and after the declaration of war he served in the Office of the Chief Signal Officer and later as Commanding Officer of the Eastern Signal Corps Unit Training Center before being promoted to brigadier general and ordered overseas in September 1944. There he was successively Director of Communications Division, Office of Chief Signal Officer; Director General, Signal Communications Service, ETOUSA; and Director of Communications, U. S. Group Control Council (Germany). He returned to this country and inactive Army Reserve status in 1945, and was re-commissioned brigadier general in the Reserve

(Continued on page 176)



In a scene which is duplicated innumerable times each day in Western Electric distributing houses from coast to coast, a stock selector adds more telephone material—dials, in this instance—to the items ordered by a telephone company which are flowing down warehouse conveyor lines on their way toward service. *See the article beginning on the opposite page*

Western Electric's Coast-to-Coast Chain of Distributing Houses Contributes Much to the Efficiency and Economy of Bell System Service

Distribution by Western Electric Company

Alvin von Auw

A MILITARY TERM, "logistics," best describes the business of Western Electric's chain of distributing houses. Theirs is a major role in the big job of moving telephone material to the front line of telephone service.

To fulfill their part in the Bell System logistic set-up, the distributing houses maintain stocks of those items which are recurrently ordered by the telephone companies, items which range in size and variety from paper clips to the heftiest reels of cable. But the distributing houses are concerned with more than the stocks they carry on their shelves. Their responsibilities extend, in fact, to every single item the telephone companies order from Western Electric. These include those items not ordered with sufficient frequency to warrant stocking, as well as major items which must be manufactured to fit a special need—central office equipment, for instance. In short, what the distributing houses don't have, they get.

Each distributing house also maintains a repair shop which reconditions used telephone company material for re-issue, or disposes of it for salvage.

But a bare statement of the threefold function of the distributing houses—warehousing, service expediting, and repair—provides only an inkling of the job they do. For a true view, let us watch a distributing house in action.

Suppose we start in the office, where the orders are received. It is a large, well-lighted room, a busy room somewhat reminiscent of a metropolitan newspaper's city room. There is the same pealing of telephone bells, the same sound of fast-tempo typing, the same murmur of a score or more of telephone conversations. And the resemblance goes

deeper than what meets the eye and ear. Just as a news story proceeds in orderly fashion from reporter to rewrite to city editor to composing room, so a telephone company order is written up and "edited" before it is passed to the warehouse to be filled.

Most telephone company orders reach the distributing house on standard order forms listing the descriptions of the items most commonly used. Telephone company field forces need only fill in the quantities required. Western Electric edits the order on receipt, separating the items known to be in stock from those which will be shipped direct to telephone company locations from merchandise stocks at Western Electric's Works or from outside suppliers.

The Bell System's "General Store"

NOW LET'S FOLLOW a telephone company order from office to warehouse. Here is a Bell System "general store." But no crossroads community ever boasted a general store like this one. The stock embraces thousands of different items—some ranged on racks, some stored in big bins, some stacked in massive array on the floor. Here are nuts and bolts and nails. Here are telephone instruments and hundreds of miles of wire. Here are pencils and typewriter ribbons. Here—in the yard outside the distributing house—are reels of cable of nearly every size and description Western Electric makes. Here are crossarms and outside plant hardware.

Long famed for the variety of its merchandise, the general store more than meets its match in the Western Electric distributing house. The distributing house has but one customer, the Bell telephone company it serves; yet its stocks must and do include almost every variety of equipment and supplies that telephone company employees require for their day-to-day jobs.

The general store that is the Western Electric distributing house is mechanized, too. Conveyors and electric trucks help speed orders to completion.

LET'S WATCH the conveyor and see how an order is handled: an order that come in from the telephone company within the hour.

It calls for a miscellany of small items, and will be filled from stock. The warehouseman at the head of the conveyor scans the order, estimates its bulk, and sets the required number and sizes of shipping containers—together with the order—on the conveyor, where it joins a continuous parade of other orders, each with enough "headway" to be well clear by the time the next order reaches the stock selectors.

As far as possible, items are arranged in racks beside the conveyor in the same sequence in which their descriptions are listed on the standard order forms. Thus, as our order reaches the first stock selector, he selects the first items required from the racks and sets them in the containers as they move slowly past his position. So does each succeeding stock selector, until the order is complete. Finally, at the end of the line, a telephone company employee checks the contents of the container against the order. Then, sealed and addressed, the order is set for shipment.

This view from the rear shows not only a Western Electric distributing house but, at the right, part of its cable dock and, in the foreground, the telephone company's garage

"Shop Talk"

ADD "SHOP" to "office" and "warehouse," and the picture of the Western Electric distributing house is complete. In the repair shop, apparatus withdrawn from service and returned by the telephone company is reconditioned and readied for a new term of service. Repaired material, returned to the warehouses, is ticketed prominently with green labels to indicate that it is telephone company property—Class "C" material, in distributing house parlance.

Repair operations in the distributing house range from work on the simplest types of plugs and cords to work on switchboards and teletypewriter apparatus. Equipment received at the repair shop is carefully inspected and the usable parts separated from those no longer usable. These latter are segregated for salvage. Switchboards no longer serviceable are a source of salvage, too. Repair shop employees "mine" their innards for usable components—relays or resistances, for instance. Such "mining" is a measure not only of economy but also of relief during times of stringent shortages.

In the repair shop you'll find a small-scale telephone assembly line from which veteran sets emerge ready—both in appearance and performance—to take their places in service beside the latest products of Western Electric factories. Worn parts have been replaced by new. Powerful jets of air have blown interiors free of dust and lint. Sets scarred in service leave the repair shop as bright and shining as the day they were born.

A Nation-wide Chain

THERE ARE 29 Western Electric distributing houses, each one strategically located with relation to the needs of the individual Bell telephone company it serves. Here is the coast-to-coast roster: Boston, New Haven,

New York, Brooklyn, Newark, Philadelphia, Pittsburgh, Washington, Atlanta, Louisville, Jacksonville, New Orleans, Detroit, Cleveland, Cincinnati, Indianapolis, Chicago, Milwaukee, St. Louis, Kansas City, Dallas, Houston, Omaha, Minneapolis, Denver, San Francisco, Los Angeles, Seattle, Portland.

Total employment throughout the distributing chain tops 7,000. As of today, the smallest house employs 53, the largest, 1,188. But whatever the size of the operation, the functions and general organization of all the distributing houses are identical. At each main house a stores manager, service manager, and shop superintendent comprise the manager's staff and supervise, respectively, the ordering and warehousing, the service expediting, and the repair functions of the house.

We have visited the shop and the warehouse, the respective domains of the repair shop superintendent and the stores manager. Now let's stop at the service manager's desk. Chances are we'll find him absorbed in a series of telephone talks with one of the merchandise organizations at Western Electric's Works on the one hand and the telephone company on the other. Linking factory and field, the service manager helps coördinate Western Electric deliveries with telephone company operating needs. His responsibility includes not only the material which passes physically through the distributing house, but also that which the house orders for shipment direct to the telephone company.

A stock selector (rear) picks out items which the telephone company order specifies, and places them in containers on the conveyor. Efficient arrangement of the stock assures fast and economical handling and shipment

The Houses as Coördinators

THE DISTRIBUTING HOUSES play a prominent part in the over-all job of coördinating Western Electric manufacturing and Western Electric buying with the anticipated needs of the telephone companies.

As Western Electric material moves along the chain of supply to the

telephone companies, a current of information on telephone company requirements moves in the opposite direction, helping Western Electric establish an orderly and adequate program of production and purchasing. To assist in this program-planning operation, the telephone companies submit to the distributing house managers estimates of their requirements for but a few basic items. From their experience of past requirements and their knowledge of the material normally associated with these basic items, the distributing houses fill out the telephone companies' skeleton forecasts. It is these forecasts which form the foundation for Western Electric's forward program.

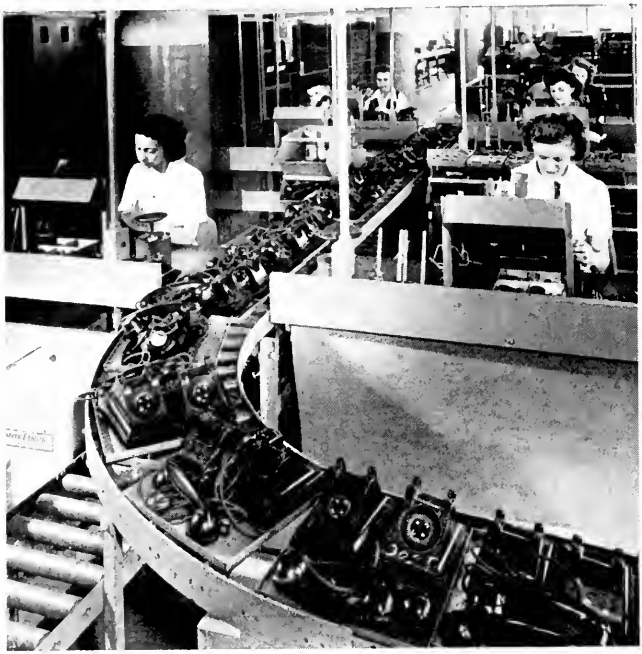
The Service Motive

MERCHANDISING, but with a difference—that is Western Electric distribution. Since each distributing house serves but one customer, the telephone company—and since Western Electric, as a fellow-member of the Bell System, shares the interests and objectives of that telephone company—the energies which might otherwise be expended in a costly sales effort are, in the present instance, devoted to *service* effort on telephone company orders. Thus it is that you will look in vain for a "sales manager" on the distributing house staff—a fact which will serve to point up the principal difference between Western Electric distribution and most other merchandising operations.

The prime motive of most distributors is profit. By contrast, service comes first with Western Electric's distributing organization. As a matter of course, the distribution houses adopt and employ those methods and procedures which best meet the needs of their customers, the telephone companies, and thus contribute at the same time to the over-all efficiency and economy of Bell System operations.

"Direct distribution" is a case in point. Direct distribution—not to be confused with direct shipment from factory to telephone company—is warehouse parlance for the preparation and shipment of small quantity orders for the use of individual telephone company plant men.

WITH THE INCEPTION and expansion of the direct distribution program, the telephone companies have been able to dispense with their storerooms in many areas and to rely entirely on the W. E. distributing house to supply the day-to-day needs of their plant forces. Under this system, the individual worker orders the equipment and supplies he'll need for tomorrow's job. On the morrow he'll find all his working wants waiting for him in his truck. This service, generally available within a given radius of the large centers where distributing houses are located, not only reduces the number of storerooms the Bell System must maintain, but also eliminates the congestion and delay inevitable when a whole shift of men report to draw their supplies in person. For Western Electric it may mean the selection and packing of as many as 4000 items in a single day at a single distributing house. But improved service, and the over-all economies to the System as a whole, make direct distribution worth while.



Repairing telephones for re-use—an important part of distributing house repair shop operations

in this era of shortages but one with which distributing house people are not content. Their pre-war standard, which they aim to achieve again, insists that out-of-stock items shall not run more than three-quarters of one percent of the total of items normally stocked.

More than fifty million dollars' worth of urgently needed telephone apparatus and supplies was restored for further service by distributing house repair shops during 1946. To the more than four million new telephones Western Electric produced last year, the distributing houses added two million reconditioned sets of every description—a contribution of the first magnitude to the Bell System roster of held orders.

The Size of the Job

TIME NOW for some statistics to show the size of the job the distributing houses do.

Take a typical distributing house. This house maintains a stock of 8,500 *different* items for telephone company use. In a recent month the house selected from its stock and shipped to the telephone company it serves some 52,491 items valued at $1,133,900. In addition, this house billed the telephone company for 8,453 items, valued at more than $3,100,789, for shipments made direct from sources of supply.

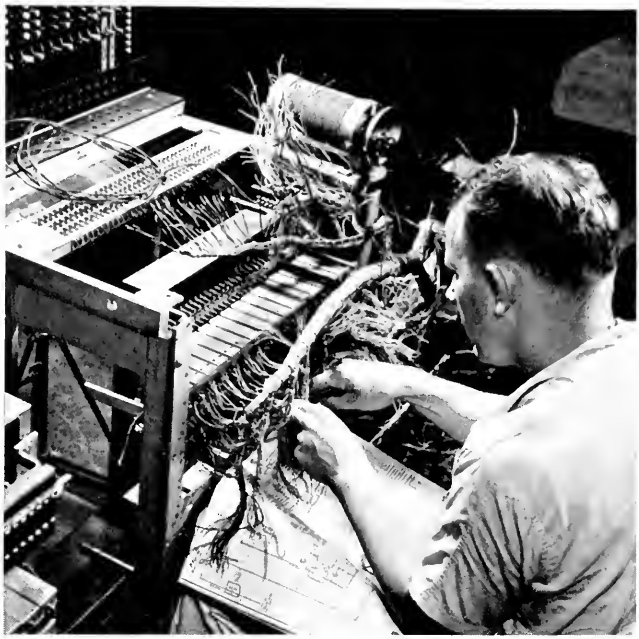
That month, less than two percent of the items normally stocked by all of Western Electric's distributing houses were not available for immediate shipment—an impressive record

Advantages of Common Management

WHAT SERVICES do the distributing houses provide, then, that the telephone companies could not as readily perform for themselves? What are the advantages of a common, centralized management for all 29 distributing outlets?

The distributing house functions could, of course, be performed by the telephone companies—and were, in fact, until something less than a half-century ago. But in the course of business evolution these functions

were transferred to Western Electric to be operated under a common management. Two sound business reasons motivated this transfer: (1) to improve service to the telephone companies and thus to their customers, (2) to reduce costs.



A switchboard section is reconditioned in a house repair shop for further useful service

First of all, the transfer of the distributing function—and the purchasing function as well—permits the telephone companies to concentrate their energies on their main job, telephone service, leaving the highly specialized business of distribution and repair shop work to an organization specifically trained for the job.

Under a unified system of distribution, each employee at each distributing location has a nationwide horizon of opportunity. Since all are schooled in the same efficient distribution techniques, employees transferred from one location to another may apply their experience directly to their new jobs with a bare minimum of adjustment and additional training. If, on the other hand, each distributing location were independently managed and if each trained its employees in its own individual techniques and procedures, the cost of Bell System distribution would be higher and service slower.

SUCCESSFUL SERVICE by the distributing houses is most dramatically demonstrated in emergencies. For in Western Electric's chain of distributing houses, all stocking standard supplies, all employing the same stores methods, the Bell System has a line of supply of proved flexibility in time of crisis. This distributing chain can bring to bear at any point where emergency might strike the full resources of the entire nationwide organization.

Take that fire in River Grove for example.* The devastated central office, serving nearly 10,000 telephones in that Illinois community, was still smoldering as the Chicago distributing house started truckloads of equipment toward the fire scene. Spurred by telephoned orders from the distributing house, the Kearny Works, 900 miles away, and the nearby Hawthorne Works, that very

* See "Crisis in River Grove," MAGAZINE, Winter 1946–47.

day started more truckloads of equipment toward River Grove to fill the communications breach. That River Grove's communications were completely restored in a record-breaking 11 days is attributable in part at least to the coördination of telephone company needs with Western Electric deeds. This was made possible by the ability of a single distributing house to mobilize Western Electric resources, near and far, to meet the emergency needs of its single customer, the Illinois Bell Telephone Company.

LESS DRAMATIC but equally evident are the routine contributions of the distributing houses to the day-to-day job of providing good telephone service at least cost.

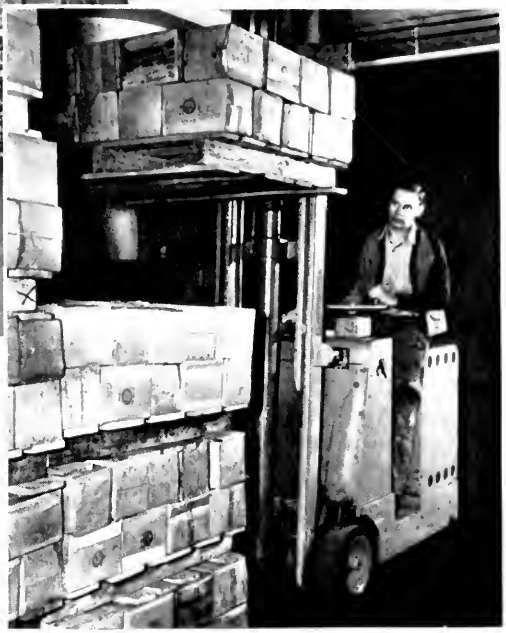
Good service with a minimum of investment in supplies is the governing consideration for Western Electric's unified distributing organization in its big job of providing the Bell System with the materials it needs to operate throughout this great nation.

Since each distributing house may draw on stocks of material at any of the distribution points throughout the country, it can furnish its telephone company with a higher percentage of needed items than if that telephone company were entirely dependent on its own stock reservoirs. And should overstocks accumulate at one house, other houses may draw on these stocks with a consequent reduction of idle investment. In addition, Western Electric circulates to all the telephone companies a centralized record of high-value items taken out of service (switchboards, station apparatus, etc.) and no longer required in the area from which they were removed. This record facilitates the transfer of such items from points where they have only junk value to points where they can be placed in effective service—another blow against idle investment.

Through centralized control of distribution, the performance of each house can be measured and improved by reference to the performance of others. To this end the so-called "red book"—its somewhat forbidding title: *Distributing House Volume and Operating Ratios*—reviews monthly the accomplishments of each house for each major cost and service factor: promptness of shipment, percentage of out-of-stock items, status of back orders, and merchandising expense. This volume is under constant scrutiny for conditions which may call for improvement.

DISTRIBUTION by Western Electric, a nationwide organization, permits expediting deliveries on a national scale. For example, personal contact by the Boston distributing house with suppliers in New England speeds deliveries to a telephone company across the country. Such service is both a convenience and a great economy for a telephone company, which might otherwise find it necessary to send its own representative on a cross-country expedition.

Similar economies derive from the nationwide supplies inspection force maintained by Western Electric's distributing organization. This force inspects Bell System supplies in the manufacturers' own plants. Any failure to meet specifications can be spotted at the source—and corrected. Working in behalf of all the Bell telephone companies, these front-line



Above: "Palletization"—the use of wooden pallets and fork trucks—makes it feasible to use vertical space for storage. Right: A fork truck lifts a pallet of material for stacking. Long metal arms attached to the front of the lift truck fit inside the wooden pallet, so that pallet and load can be moved about or can be raised to as much as 14 feet above the floor

observers employ uniform inspection standards, thus eliminating wasteful duplication of inspection effort by each company. This arrangement simplifies the supplier's problems, too, enabling him to operate with minimum confusion, minimum cost.

New Tools and Methods

THE DEVELOPMENT of new and better methods and tools for distribution and repair is the concern of a central organization of specialists whose accomplishments contribute to the improvement of service to every Bell telephone company by every distributing house. Through the efforts of these specialists, each telephone company gets the benefits of a far-reaching program of distribution engineering which no one of them could economically support alone.

As Western Electric's manufacturing engineers devise new and better ways of making telephone products, so these "engineers of distribution" develop and design the special equipment—the tools, gauges, and test sets for the distributing house repair shop, the tabulating equipment for the office, the conveyors and material handling equipment for the warehouse—which contribute to the efficient distribution and repair of those telephone products.

Conspicuous among the contributions of these engineers has been the introduction of machine billing at all

but the smallest distributing houses. The uncanny machines in distributing-house billing rooms turn out bills quickly and accurately on the basis of information supplied to them in the form of pre-punched cards. These bills and statements are set forth in the telephone company's own accounting terms and are checked by the telephone company's own invoice supervisor, who is stationed at the distributing house. Thus the telephone company can make charges directly to its various accounts without further computation or summarization.

Western Electric engineers contributed materially to the development of these machines. The manufacturer pays royalties on a number of Western Electric-developed features.

"Unit packaging" is another subject of constant study by distribution engineers. The final shipping containers employed by the distributing houses embody a careful consideration of factors of shape, size, and weight, to make handling and storing easier. "End use" governs the design of small-quantity containers for individual telephone company plant men—the objective: to minimize the number of times the package must be opened to select and count material from its contents.

Handling Materials

THE "UNIT LOAD" METHOD of materials handling, made practicable by the introduction of the pallet and the fork lift truck (see illustration on page 121), has been the subject of study and experiment by W. E.'s distribution engineers since our Armed Forces demonstrated the advantages of this revolutionary technique by their phenomenal accomplishments during World War II.

A pallet consists of a double-faced platform a few feet square and a few inches high with open ends, on which materials may be piled. The two surfaces permit the stacking of one pallet load upon another. A fork lift truck is a small self-propelled vehicle with flat protruding forks in front which may be elevated and lowered. Inserted between the faces of a pallet, the fork can lift pallet and load and maneuver them until they are lined up above a stack or other location and then lower them accurately into position.

Adapting "palletization" procedures to telephone materials handling is now well advanced, and the tools of the technique have been supplied to all distributing locations. While many difficulties remain to be surmounted, the use of pallets has already proved itself in distributing house practice. The time, space, and money savings already evident call for a continuing expansion of this program.

Repair-shop equipment developed by the engineers of Western Electric's distribution organization includes a water-wash paint-spray booth, portable self-contained exhaust and dust separators, individual test current-converter units, telephone test sets, tubular fuse test sets, and PBX test sets. And these are but a few among hundreds of developments which, through the years, have reduced the cost or improved the quality of distributing-house repairs. Not many of these hundreds could have been accomplished if common management had not channeled the experience of all 29 repair shops into

a single central engineering organization.

DISTRIBUTION ENGINEERS are as much concerned with quality control as are their colleagues in Western Electric's manufacturing organization. In the repair shop, as in the factory, strict tests guarantee the quality and uniformity of products, new or renewed. To insure uniformity of inspection standards throughout the distributing chain, quality control engineers from the headquarters staff make the rounds of the repair shops, conducting independent inspections of their own. The results of these survey inspections are matched against the local inspection results obtained by the repair shop organizations themselves, so that the same high standards of quality control may apply in every distributing house. Undesirable conditions detected in one repair shop can be corrected before the same conditions appear elsewhere. Curative measures found successful in one area can be made available to all others simultaneously.

Bell System standard practices govern the inspection procedures observed by the distributing houses. Issued by the Bell Telephone Laboratories, these practices incorporate the expressed requirements of the operating telephone companies. Thus, in the final analysis, the telephone companies themselves establish the standards for the Western Electric repair shops which serve them. The system of centralized survey inspections, conducted under common management of all the distributing houses, is double guarantee that these standards, so important to the country's telephone service, are scrupulously maintained.

And through the efforts of the headquarters engineering group, the efficiency and economy of operations at each individual distributing house are constantly improved through the common experience of all. The advantages of Western Electric's nation-wide training and experience which accrue to each telephone company must be obvious.

LEST too much emphasis seem to be placed on common management and centralized control, let it be said now that the success of each distributing house depends on the degree to which it serves the needs of the local telephone company. The efficiencies and economies to be derived from centralization are matched by the efficiences and economies which derive from the close day-to-day working relationship between the distributing house and the telephone company it serves. It is this relationship—and the cumulative experience of this relationship—that translates telephone company needs into Western Electric deeds.

It is a long way from the factory to the front line of telephone service.* Yet in the distributing house it is sometimes difficult to tell where Western Electric leaves off and telephone company begins. For the distributing houses are bridges, linking the supply unit of the Bell System with the operating units of the System. Over these bridges pass the vast quantities of materials that help make telephone service.

---

* See "Final Steps in Supply Distribution," QUARTERLY, October 1940.

How Big Are the Little Things In the Telephone Business?

Keith S. McHugh

Editors' note: This is the text of a talk given at the Bell System public relations conference last June by the A. T. & T. Vice President in charge of public relations.

NOT LONG AGO I made a talk about some aspects of our business before a group of men, most of whom are presidents or officers of their companies. During the talk I had occasion to refer to the size of the Bell System in terms of plant investment and number of employees.

After the talk was concluded, a number of the men continued the discussion, and one, who manages a large business, said "I think the telephone company has done the finest management job in business. It is a great institution. But I am sorry to say that I don't see how you can possibly hold that place, because you are getting too big. No business as big as yours can possibly be efficient." Some of the others present clearly agreed with him.

I did my best to convince them that we are fully aware of this danger. I pointed out that we continuously carry on research; we have developed a highly competitive system for all supervisory personnel within our business; and we practice real decentralization of authority and responsibility. But I doubt if they were fully convinced that these measures, as good as they might be, were enough.

There are different ways of characterizing the elements of a successful business, but we may confidently assert that somehow the following elements must be present:

1. *A good product or service sold at prices which are so attractive that customers will spend their money for it and come back for more.*
2. *Investors who are impressed sufficiently with the record and prospects of the business to risk their savings.*
3. *A management which can produce adequate earnings over the long pull.*
4. *Employees who are well paid, enjoy good working conditions, feel secure in their jobs and, in the main, sincerely believe (and willingly tell their friends) that the company is a good employer.*
5. *A forward-looking policy of research and development to keep abreast of or ahead of the competition for the customer's dollar.*
6. *A way of doing business which earns a general reputation as a good citizen.*

There may be other elements which you think should be added to the list. And their number, and the emphasis placed on each, changes with the times. Many years ago only the first three—a product which would sell, a willing entrepreneur, and good earnings—were considered by many business men in America as all that was required for the success formula. Emphasis

on fair treatment of employees, on research and development, and on good citizenship is generally of fairly recent vintage.

I think we may fairly say that the telephone companies—perhaps because of the unusual characteristics of their business—early gave more attention to these last three points than did many other businesses which did not have to be particularly concerned about State and Federal regulation and scrutiny, which were satisfied to do a minimum of product research or design, and which were unimpressed with the idea that they had to be good citizens in the communities in which they had plants or sold their products. But today, almost all large businesses are aware of these requirements; and the telephone companies, instead of being the leaders in practicing these virtues, now have lots of company in the front rank.

TODAY I would like to discuss some phases of the first requirement, good service, and of the last, good citizenship, with particular reference to the question raised earlier, namely, "Are we becoming so big that we can't possibly be efficient?"

The dictionary defines the word "efficient" as "highly capable or productive, or effective in operation." Let me point out that this definition covers a lot more territory than the behavior of a dial switch, the layout of a cable network, or the filing of customers' records in a business office. It also tells us that real efficiency in our business depends on people doing all the things—including the little things—that may be, as the dictionary says, highly "effective in operation."

On what do other people base their ideas of the efficiency of the telephone company? It seems to me that their ideas come from their reaction to that part of the company's operations which touches them most as individuals. Thus, a stockholder interested primarily in his telephone investment no doubt judges our efficiency in terms of reliability of earnings and dividends and in the value which others place on his investment. Bankers, insurance companies, investment counsel, financial writers—all might make these results the first test of efficiency.

USERS OF OUR SERVICE think we are efficient when we get their calls through promptly; we are inefficient when the calls are delayed. When a toll operator goes to some unusual trouble in locating the called person or performs some special service in an emergency, the recipient of this service not only thinks we are efficient, but is apt to talk about it to others. When a user gets a bill that is in error, but receives courteous treatment of his complaint by the business office representative and prompt correction, he may think we are efficient despite the error; but continued errors or bad handling of a single error make him think us inefficient. If his telephone goes out of order and we have a man out at his home promptly to fix it—and especially if we find the trouble first, and repair it before he report it—we are very efficient. But if we are slow, or the telephone stays in trouble after repair, he thinks we are inefficient.

The people who make up the public are citizens as well as telephone users, and think of us from both points of view. As citizens, they drive through city streets and over country roads and see our crews at work; they think we are efficient or not efficient based on what they see these crews doing. They form their judgments when we make pole placements, trim trees, construct buildings, open the streets to place cable; in fact, when enaged in any of the multitude of operations which are necessary to our business. These offend if done carelessly or thoughtlessly; they please, or perhaps fail to offend, if done well.

THE CITIZEN forms judgments of our operations in other ways. Do telephone people as citizens or as representatives of the company participate actively in worthwhile community affairs? Does the company contribute to worth-while community

enterprises—prodigally—fairly—in a miserly way—or not at all?

Do telephone men and women take so whole-hearted and genuine an interest in the community that it never occurs to other citizens to question their enthusiasm and freedom to act on community problems? Do most decisions of the company, of importance to the community or its citizens, wait interminably while impotent local management checks headquarters? Are telephone rate practices and commercial policies designed in the best interests of the community, and are they watched and changed to keep them that way as conditions change?

These questions illuminate a simple truth, but a truth of great and continuing consequence to the success of the business: *In the long run, people's ideas of our efficiency are determined largely by the* little *things we do or fail to do.*

I am assuming, of course, a fundamentally good technical service job and sound general policies. Beyond these, the fact and quality of the "overtones of service" and of what we might label correspondingly the "overtones of corporate acts" are the things by which people judge us. The little extra courtesies of the commercial representative, the installer, the repairman, the operator; the character of personal interviews with customers whether rich or poor, prominent or unknown, to explain errors or service difficulties or perhaps the inability to give any service; the knowledge of the company and its policies displayed by employees in making explanations of matters outside their special skills and their belief in the company; the manner in which we deal with city, county, or state governments; the care we take with the property of others—their trees, their view, their streets and highways; these are what I call the "little things."

THESE LITTLE THINGS give the public and telephone users the bases for measuring our efficiency. And they do more than that if done well—they make our character and give us our reputation. They make a joy of the job to each of those who do them. There is so much more fun doing a job which is pleasing to other people than in doing one which is not.

If we can manage it so that our own people, or nearly all of them, get a kick out of their jobs by doing these little things thoughtfully and well, we need have no fear that the people of America will say anything other than "We think the telephone companies are all right. They are good employers, have good people, and are good citizens." We need not be concerned about the size of this business, whether or not the Bell System's plant investment goes to ten billions of dollars or the total of employees goes to a million. Our companies' fundamental standing will have been made in the communities of America where it must be made, and home-town folks will take pride in their home-town telephone friends and neighbors and in their home-town telephone company.

And manage this we must. As our companies increase in size, in distance from top to bottom, and in difficulty of implementing ideas, we in management must work unceasingly to hold our gains in the doing of the little things and in improving their doing. This is the fact which all telephone management must face and to which we in public relations must make a maximum continuing contribution.

Natural or Synthetic, They Are the Product of Chemical Science, Possessing Properties Which Fit Them Well for Important Communication Functions

Plastics—Their Growing Use in Telephone Plant

John R. Townsend

THE FIRST telephone receivers to be produced in any quantity, after wooden casings were abandoned 'way back in 1877, were made of plastic material.

So are the operators' light-weight head sets adopted in the Bell System in 1946.

The old telephone receivers were created out of hard rubber: "hard" because Goodyear's discovery of how to vulcanize the soft latex from the trees made it possible to mold and harden *natural* rubber. The new light head sets are formed out of phenol plastic: *synthetic* (artificial) material which also can be given useful shape through the application of heat and pressure.

These are but two examples, out of many, of the Bell System's adoption and adaptation of materials and processes to special uses in the communications field. As natural materials become scarce, and as new types of synthetics are developed, plastics are playing an increasingly important part in the manufacture of many elements of telephone plant.

Lead, for example, has been the major component of telephone cable sheath since copper wires were first successfully enclosed in its protective embrace. In recent years, lead has been in scarce supply.

Are we about to produce lead synthetically then? No indeed. But what we are doing is developing combinations of synthetic materials which may turn out to do as good a job of protection as lead did, and may therefore be an alternative and a supplement to lead. Specifically, the excellent water-resisting properties of polyethylene and rubber thermoplastic give promise that, when combined in "sandwich" construction with metal tapes or thin metal sheaths, these materials will provide a workable substitute for lead cable sheath.

The adaptability of plastics is illustrated by this variety of plastic products, including the combined set housing and finger wheel; the operator head set with plastic caps on transmitter and receiver; and key buttons, plug insulation, and connector block and cover

Textile insulation for wire has also been hard to obtain in sufficient quantity, and the possibilities of using plastics here are being studied. Extruded plastic coatings on copper and aluminum wire may become of great importance in the telephone business. Drop wire jacketed with neoprene; switchboard cable jacketed with polyvinyl chloride; switchboard wire insulated with polyvinyl chloride and polyethylene; neoprene and nylon for sheathing: all these are on trial.

A rapidly growing field of use is that of the new adhesives, which are compounded of various plastics. These adhesives are very strong, permanent, water-resistant, and unaffected by fungi. They may be applied successfully to join many materials: other plastics, wood, ceramics, even metals. It is these qualities which make possible the creation of composite or "sandwich" products combining properties no single material can possess. Think of them in terms of the prefabrication of many things used in the telephone business: from movable central office partitions to portable equipment, from telephone booths to cabinets for the micro-wave repeater project. Those are, of course, for the future.

A Future—and a Past

New uses, new applications of plastics are developing day by day. It is a lively and growing industry. But it is by no means all new: plastics have a past as well as a future. Actually, much telephone apparatus of one sort and another—some of it entirely familiar—has long been made of plastic material. The hand tele-

phone is one example; the combined-set housing is already becoming another. From plastic materials are made dial finger-wheels, connector blocks, key button tops, plugs, vacuum-tube bases, protector mountings, and insulators of various kinds.

A plastic may be any one of a great number of materials and of both natural and synthetic origin. For example, phenol plastic, rubber, shellac, methyl methacrylate, are all plastics. Rubbers may be either natural or synthetic, shellac is natural, and phenol plastic is synthetic. Plastics are very often combined with other materials as fillers. They may be used as paints and adhesives.

The common denominator of all plastics is that at some time in their career they must be capable of being cast, extruded, pressed, formed, after which they cool or age to comprise a usable part. The flowing or plastic deformation may be carried out by heat, by pressure, or both. Some plastics are fluid to begin with and are cured or changed to a harder substance. When this happens, solidification or polymerization, or both, may take place. The former means the combination of two or more molecules with the liberation of water, hydrogen chloride, or other material, to form a new substance. Polymerization is a chemical process resulting in the formation of a new compound whose molecular weight is a multiple of that of the original substance.

For convenience, plastics may be

Combined-set bases travel by conveyor to the next process after being removed from the injection molding machine

Vacuum tubes with plastic bases are placed in aging racks, where they are stabilized and tested

divided between thermoplastic and thermosetting materials. The former comprise those substances that can be re-softened by heat. The latter cannot be re-softened because a non-reversible chemical change has taken place. Cellulose acetate, methyl methacrylate, are examples of the former; phenol formaldehyde and urea formaldehyde are examples of the latter.

Compounds and Qualities

THE COMPOUNDING of a plastic is a highly skilled art. Fillers are added to provide bulk, strength, and electrical characteristics. Plasticizers are added to increase flow and workability. Pigments and reenforcing materials also form a part of the compound. Thousands of compounds are thus available for use.

Plastics as used in the Bell System may be grouped in three classes, each characterized by particular qualities.

One is for applications requiring mechanical strength: the ability to hold to original shape and size, and to stand up under impact, wear, battering and bending and stretching.

Another is for electrical applications where insulation and arc resistance and non-conductivity are important.

Still a third class is for general application where an economical part of pleasing appearance and reasonable strength and perfomance is desired.

These are the broad bases on which a particular plastic may be selected for a particular use or service. Any or all of these desirable qualities may be useful in practical application.

The earliest plastics in the telephone plant were insulating materials such as hard rubber, vulcanized fibre, and shellac-mica compositions. Among the first synthetic plastics was Bakelite, which came to be used in molded form and as the resin in phenol fibre.

Phenol plastic forms an insulat-

ing material used mainly where stability combined with reasonable strength is important. It is used for our telephone hand set. This particular compound consists of phenol formaldehyde resin with 50 percent filler, the latter being a mixture of wood flour or ground wood and cotton floc or linters. It is cheap, strong, mechanically stable, and chemically inert. As a rule, and this is true of most plastics, the parts come from the molding die substantially ready for use with excellent surface finish.

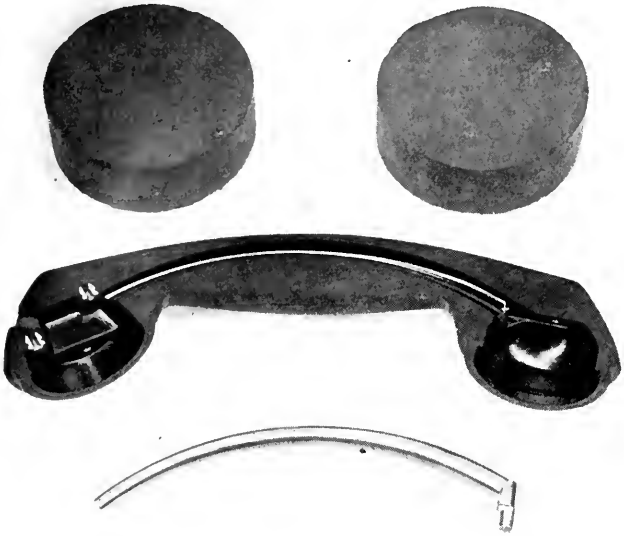
A new operator head set, with plastic caps on transmitter and receiver, gets a "talk test"

Akin to phenol plastic is phenol fibre. This is made by impregnating various types of absorbent paper with phenol formaldehyde laminating varnishes. After drying or partially curing the resins, the sheets of varnish-impregnated paper are stacked in a press and cured under a pressure of one-half to one ton per square inch at a temperature of approximately 325°F. for about one hour.

Plastics as Insulators

VARIOUS GRADES or kinds of phenol fibre are used. These vary in resin content and formulation and in the character of the surface sheet. High resin content produces good electrical characteristics; lower resin content, good mechanical strength; and for certain grades a tung oil plasticized varnish is used. Instead of paper, cloth may be employed to obtain variations in strength and appearance.

Organic plastics do not conduct electricity, and hence form insulators. These insulators must be very good, so that the telephone's comparatively feeble electric currents will not leak away or be lost in transmission. Telephone apparatus must also be stable, so that the adjustment of relays, keys, switches will be reasonably permanent. Insulators must not deteriorate chemically or affect adjacent parts nor cause corrosion or deterioration. Consequently, the properties of mechanical and chemi-



Out of these components will come a hand telephone. Top to bottom: plastic pre-forms, half section of molded handle, and core

cal stability are of predominant importance in the telephone art.

Plastic parts that are placed in the hands of the public—hand sets, for example—must not only be good insulators, but must be chemically stable and not affect the subscriber's person. Appearance, fire hazard, physical strength, and manufacturing facility are properties of considerable importance. Other qualities are, for instance, specific gravity, tensile strength, electrical characteristics, and availability.

Plastics vary greatly in price and in processing costs. The selection of the most suitable plastic for a given application is thus a complicated engineering problem.

Plastics have brought in their train several difficulties which must be dealt with in apparatus design. Age cracking or crazing can occur with some plastics in ordinary atmospheres, when flexed or strained, or in contact with solvents. The latter factor is particularly important when certain household cleaners are used.

Fastness to light, and particularly light and humidity, is a problem. This is of major importance with colored objects where a pleasing appearance is desired. Exposure tests have been carried on for years on the roof of the Bell Telephone Laboratories in New York. Tests have also been made at various locations throughout the United States:—Miami, Key West, Pittsburgh, Sandy Hook, and in the Panama Canal Zone. Thousands of specimens have been exposed and tested in natural as well as artificial environments. These have been specific telephone parts, combinations of parts, test panels, corrosion couples, etc. As new plastics appear, more tests are made. Fatigue tests by reversed flexing or by repeated impact are of great importance for dynamic uses.

New Manufacturing Arts

THE GROWING USE of plastic for telephone parts—the hand set, the operator's head set, the housing for the combined set, to mention only a few—has required the development of new manufacturing arts on the part of the Western Electric Company—the supply branch of the Bell System.

For many years, the insulation used on telephone plugs—the insulated metal end-piece attached to a connecting cord—was of hard rubber. Not infrequently, during the assembling process, metal chips would be picked up which would short-circuit the insulation. The injection molding of plastic material for insulation of the plug parts eliminated this difficulty and produced a plug with better and more stable insulation.

Originally, the connecting wires between transmitter and receiver of the hand set telephone were inserted in the mold before heating. As a consequence, it was hard to keep the wires apart during the operation, to avoid a subsequent short-circuit; and the plastic material at the center of the handle was not always fully cured. Now, the use of a metal core, which is a Western Electric development, not only keeps the wires separate, but permits the molding of a dense and very strong handle.

This can be brought about because, as a general rule, materials which are good insulators, and hence poor conductors of electricity, are also indifferent conductors of heat—since these properties tend to go hand

The hot pre-forms are dropped into the dies, the press closes, and in three minutes seven new hand telephones emerge

in hand. It has been difficult to cure heavy sections of phenol plastic because of this quality of poor heat conductivity, and thus the center of the hand set was not fully cured. A development just before the war demonstrated that the center of thick moldings could be "cooked" by the use of high-frequency electrical heating:—diathermy if you please.

For the hand set, specially compressed pellets of dry molding powder are placed betwen two plates in the output of a 14-megacycle 7-kilowatt oscillator for half a minute. This heats the pellets through by dielectric loss: the dissipation of the energy induced in them. The pellets come from the heating apparatus in a soft state, and may be quickly formed by pressure to the desired shape. This "curing" reduces the total process time, and produces a hand set of superior strength.

ANOTHER PROCESS that has become of great practical importance is that of casting resin. The resin is placed in a mold in liquid form, and is caused chemically to react by the addition of a catalyst to become a hard and infusible substance. During the war, casting resins of this type were used to make porous metal castings water and air-tight. This is possible because of their very low shrinkage.

Following the war, it was found possible to cast terminal strips in simple molds into which the terminals are inserted and the mold is filled with the casting resin compound. The particular resin used is a mixture of polystyrene monomer and a polyester plus a catalyst. In order to economize in the use of the plastic material, and also to reduce shrinkage and improve the stability of the casting, about 40 percent silica is added to the resins. Spun glass floc is also added to improve strength and some titanium dioxide to color the casting white. This is another example in pioneering by the Western Electric in a new field.

Western Electric also pioneered in the injection molding of so complicated an object as the combined telephone set.

A New Science

PLASTICS are competitive with other materials and processes, such as welding, casting, sheet metal fabrication. Good engineering must start from service needs and proceed to the selection of the best material and process from the standpoint of basic costs and adequate life. Plastics will replace some of our older materials because they will be better, and there will be instances where the molding process will provide economy over other processes in spite of higher cost of material.

Synthetic plastics are a product of modern chemical science and have no counterpart in natural materials. Practically all of these plastics are new. A large majority of them have come into commercial use since 1930, and some of the most valuable plastics from a communication standpoint, such as polyvinyl chloride and polyethylene, have been available only since 1938 and 1941, respectively. We do not have, therefore, the background of solid experience and familiarity of a great variety of service conditions with these new plastics that we have with natural and the older synthetic plastics—such as Bakelite, which appeared in 1909,

and cellulose nitrate, which appeared in 1868. Any prospective use of these new plastics requires intensive laboratory and field trials and compilation of experience data from service.

Bell Laboratories' Part

At Bell Telephone Laboratories, a division of the Chemical Department is indeed devoting itself to development and engineering studies of plastics. This group is primarily concerned with the application of plastics in the design of telephone apparatus, and one of its functions is to bring about developments in the plastics industry which can be used to advantage by the Bell System. Research efforts in this group have led also to the development of interesting new plastics, among which is Paracon, a synthetic rubber having valuable properties.

Plastics are not yet available for all of our needs, nor are they a panacea for all of our difficulties. But it is to be expected that their use will increase with developments in modern chemistry.

Automotive Authority

At about the time that Temple C. Smith's "Keeping Our Automotive Equipment Modern" appeared in the last (Summer) issue of this Magazine, a shorter version of it, described as a "guest editorial," was published in *Fleet Owner,* a trade journal of the truck industry. Our readers may be interested in that publication's estimate of Mr. Smith and his job:

"It is fitting that Mr. Smith should be invited to be a Guest Editor. His position with the telephone system brings distinction, as this organization operates one of the largest fleets in the country. Mr. Smith also speaks with authority, based on a good technical education as the foundation for many years of practical application of engineering principles to automotive requirements.

"It is fitting also that Mr. Smith selected a subject that points to what ultimately may become the predominate post-war trend—that of engineering the vehicle to the job. His company has had much experience in this direction, for the telephone fleet is called on to perform many jobs.

"Most of us may think of the telephone truck as a piece of equipment that stops in front of our home from time to time, while the repairman inspects the instrument or strings a new line of wire from the house to the nearest pole.

"The telephone company's fleet has many other tasks to perform, involving hauling and supplying of power.

"The engineering involved in producing the right equipment must have presented Mr. Smith with many interesting problems. Out of this vast experience has come some guide posts, and these should prove of great value to other operators in rebuilding and adding to these post-war fleets."

Excursion in Engineering

Carroll O. Bickelhaupt

Editors' note: At the commencement exercises of the South Dakota School of Mines and Technology, held at Rapid City last June, Mr. Bickelhaupt, who is Vice President and Secretary of the A. T. & T. Co., received the honorary degree of Doctor of Engineering. The following paragraphs are excerpts from the commencement address which he delivered.

UNTIL COMPARATIVELY RECENT TIMES, the social effectiveness of the engineer was largely indirect or undirected. As new vistas of scientific knowledge were opened up, he went ahead with the job of applying these discoveries to the finite satisfaction of human needs. The scope of his endeavor, however, has been circumscribed by the incentives of his professional environment and he has confined his work mainly to the objectives of industrial enterprise. Meanwhile, he has left to those in the field of politics the control of the social implications of his output.

But the engineer had done such a good job in providing the tools and processes of production, and had done so much to make life better, happier, and freer, that when his work began to react perceptibly upon our social pattern, the rule makers of government began to look to him for help in meeting the problems of human relations with which our social, economic, and political system is confronted. Thus, whether, as engineers, we planned it that way or not, and whether we like it or not, we have, I believe, arrived at a point in our professional progress where we must take an increasingly active part in social research and social planning and social orientation.

The problems of human relations are broad and complex. Like many physical problems, they have not been and quite likely can't be solved by individuals. It is difficult to believe that any one brain can even comprehend, much less analyze and evaluate, the delicately interlaced fabric of human desires, impulses, behaviorism, and its complex of interreactions. But there is basis for hope that one by one these intricate problems, the solution of which is so important to us all, may yield to coöperative research.

This is a method in which scientists and engineers are well versed. The scientific approach has been applied successfully to the solution of many material problems. It is deliberate but thorough. There is no place in it for the prejudice, bias, subjectivity, and wishful thinking which have been so evident in our dealings with human affairs and relations, particularly during recent years.

I have the notion that many of the social or human problems we worry about and that trouble us from time to time are in the nature of transient phenomena. Like sudden but temporary surges of current in electrical transmission lines, they sharply upset the pattern of our social environment, do violence to our sense of security, and shake the confidence we have in our ability to pursue the good life. Steinmetz, in his classic volume, "Theory and Calculations of Transient Electric Phenomena and Oscil-

lations"—a book which, as an undergraduate, I found even more formidable than its title—disclosed the pattern of these violent but temporary electrical surges, formalized man's experience with them, and developed the mathematics for predicting their nature, energy, and duration. I have no doubt that some of you here today will cooperate in similarly opening up new fields of knowledge with respect to transient social forces.

In any event, you will find yourselves more and more required to extend your work and thinking beyond the limits of material science and its applications, and you will find yourselves more and more concerned with the social implications of your output. As you advance in your profession, do not make the mistake that has been made so often in the past. Do not forget that man's progress in the pursuit of happiness cannot be hastened by expedients or by "first aid" treatment, and that it will come not through regimentation by the few but by the long-range processes of individual liberty.

I purposely use the good old engineering term "long range," because mankind forges slowly but surely ahead as more and more people are freed to think for themselves, to take on more and more responsibility, and as the individual is increasingly dignified and respected for what he is and can make of himself. On the other hand, as his individual freedom is circumscribed, man tends to retrograde.

I think you, as engineers, will have to concern yourselves in your work, more than my generation has, with secular trends in social forces. Many of you will play an important and vital part in business. You will provide the tools of industry and be looked to for much of its planning. You must see to it that your work is socially oriented. You must take the long-range view. You must apply the proven procedures of scientific approach and coöperative research to the human problems of industry and society. Above all, you must continuously defend the freedom of the individual. How well you do this will be a measure of your professional progress.

Towards the latter part of World War II, when the Allied armies in Europe were pushing the Germans back across their own frontiers, and military, naval, and air activities in the Pacific were building up in the crescendo which defeated the Jap, a friend of mine who was Chief of our Army Communications Service became impressed, and not a little concerned, about the volume of traffic the American military communications system was transmitting around the world by wire, submarine cables, and radio between and within the respective theaters of operation. Upon adding up the volumes of command and administrative traffic the Army Communications Service was handling by telegraph only, he found that for every small-arms and machine-gun bullet fired by the American ground and air forces, eight words were being transmitted by the Army Communications Service. He concluded then, he says, that "the pen is mightier than the sword."

Whether or not you agree with this conclusion, you may be sure that words are going to play a most important part in your working and professional life. They are the tools of your trade; the "vehicles of ideas." You must learn to use them and to make them work for you. To the extent to which you are able to do this, your professional path will be smoothed and your progress accelerated. I venture to say that for many of you this is going to be one of the hardest, yet quite probably one of the most important things you will have to do in the next few years after graduation.

I have already referred to Leonardo da Vinci as an engineer whose engineering achievements are little known and are overshadowed by his fame as an artist. Unfortunately, as Vallentin points out, "his unique career, a lifetime devoted to research in every field of human knowledge, ended without the publication even of fragments

of his conclusions. Mankind was to have to discover afresh the paths he had trodden and mapped, to fall into his errors after he had recognized them, to struggle out of the traps he had evaded."

Then too, we heard a good deal, not so many years ago, about the men who were so urgently needed and essential to the Washington scene: men whose qualifications, it was said, "must include a passion for anonymity." My impression is that I have read more about these men in the public press and heard more about them on the radio than I have ever heard or read about the great engineers who have done so much, among other things, to bring newspapers and radio broadcasting into the daily life of the nation.

Francis Bacon said, "I hold every man a debtor to his profession." If the engineer is to pay the debt he owes his calling, he must become articulate. He must acquire and practice the persuasive arts. If he is to occupy the place in our society which is rightfully his by accomplishment, he must tear aside the veil of anonymity with which his vocation has been shrouded since its beginnings.

And so I say again, words are important to you. I urge you to learn to apply them to your professional ends. They are the media of communication, and communication is the basis of coöperative effort.

THE PROFESSION you have chosen is not an easy one to follow. Its pursuit is arduous but its rewards are great. It holds out the romance of the untraveled trail and rewards its followers with the satisfactions that come from finite creation. Do not be dismayed if you meet with disappointment. Yours is an honored profession. You have a great and useful place to fill. You have taken the first long step towards your goal, and the fact that you are here today denotes that you have done it well.

Some of you, I suspect, have served in the Navy. Those of you who have, and those who have followed naval history, know that the highest praise a naval commander can give is summed up in the terse and simple signal, "Well done!" That signal should be made at every convocation where the graduation of engineering cadets is celebrated. It may well be supplemented, also, by that forceful message of hope and faith I have heard the great War Prime Minister of England, Winston Churchill, thunder out in his country's dark hour; that one-word fighting message, "Dreadnaught."

When he invited me to talk with you at this convocation, your president graciously indicated I might address myself to any subject I wanted to talk about. He went on to suggest, however, that I refrain from "preaching." He didn't use exactly those words, but his meaning was entirely apparent to me even if delicately expressed. Taking him at his word, we have strolled in and about the engineering scene today much as sightseers. If you have acquired any impressions of its human climate, our excursion has served its purpose. But if I should be accused of preaching to you, let me at least make sure I am not charged with preaching without a text, even though I conclude with it rather than begin from it as is the classic manner.

Let me mark the end of our excursion by quoting to you from Robert Louis Stevenson, not because what he has said in this passage bears implicitly upon what I have tried to say today, but because it is something for each of us to remember, particularly when the horizon is dark about us and our world is troubled, and especially because it is the specification of our most important individual job:

"To be honest, to be kind—to earn a little and spend a little less, to make upon the whole a family happier for his presence, to renounce when that shall be necessary and not to be embittered, to keep a few friends, but these without capitulation—above all, on the same grim conditions, to keep friends with himself—here is a task for all that a man has of fortitude and delicacy."

Post-war Information from Official Sources throughout the World Permits Compilation of Up-to-date Communication Statistics for Most Countries

Telephones in the World Of 1947

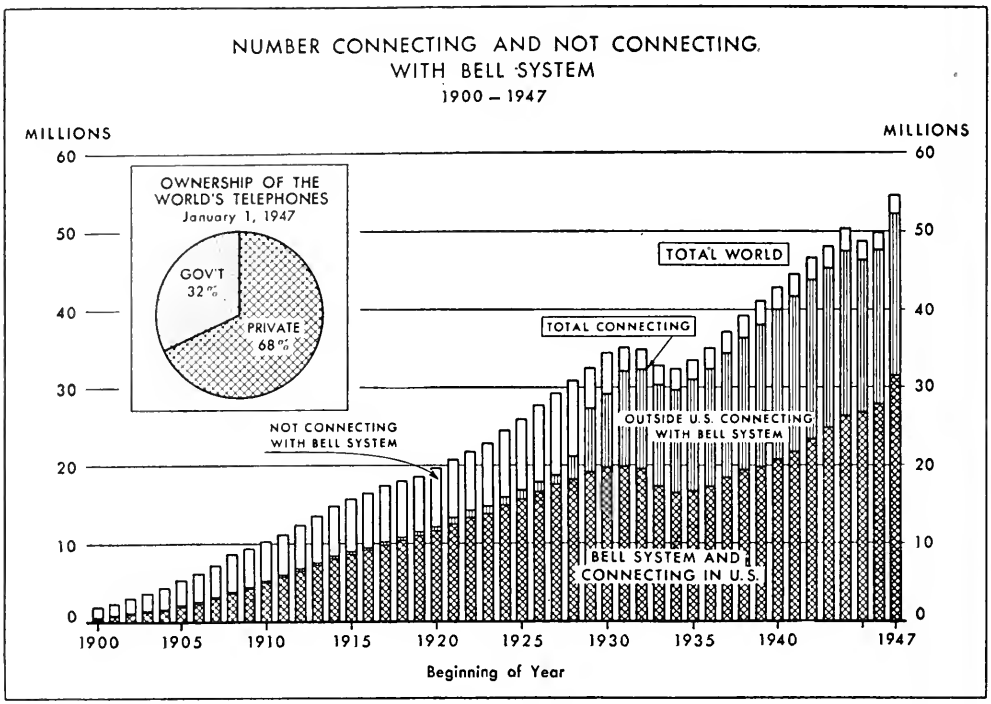
James R. McGowan

In 1876 there were two telephones in a world of 1.35 billion people. "The most wonderful thing in America," was how Lord Kelvin described Alexander Graham Bell's telephones, which were then being exhibited at the Philadelphia Centennial Exposition in June of 1876. On January 1, 1947, in a world of 2.35 billion people, there were 54.6 million "wonderful things."

A compilation showing the status of world telephone development, by countries, as of January 1, 1947, the twenty-seventh issue of *Telephone Statistics of the World,* was issued recently by the Chief Statistician of the American Telephone and Telegraph Company. This bulletin, based upon information obtained directly from private and governmental communications administrations throughout the world, has appeared annually since 1912, with the exception of those periods during World Wars I and II when telecommunications data on a world-wide basis were not available. Although the current edition is broader in scope than that of the preceding year, telephone statistics for some of the war-torn countries, notably Germany, are still lacking, while statistical data pertaining to the communications facilities of other nations, such as Italy, the U.S.S.R., and Yugoslavia, are incomplete. However, allowance has been made for these factors in estimating the continental totals shown in the bulletin from which the accompanying charts and tables are reprinted.

The First Million Telephones

The year 1899, twenty-four years after Mr. Bell had successfully demonstrated his telephone theory by experiment, saw the United States attain its millionth telephone, while all the rest of the world had arrived at a total slightly less than that. Since



the beginning of this century, the ideal of universal telephone service has assumed greater and greater significance. Through continuous and vigorous research in the telephone art, the Bell System over the years has made many outstanding contributions to a service which today places 96 percent of the world's telephones potentially within the reach of any Bell System subscriber.

The Telephone in America

More than seven billion dollars' worth of telephones, switching equipment, wire, cable, buildings, vehicles, and other physical plant stand behind the largest communications system of the world, that of the United States. Under the stewardship of private enterprise since its inception, the telephone system in this country has always maintained world supremacy both in absolute size and in telephone density (i.e., number of telephones in relation to population). At the beginning of 1947, a development of 22.37 telephones per 100 population was attained, or a telephone density almost ten times that for the world as a whole. This development has been attained despite the fact that the telephone companies in this country have unfilled orders for more than two million new telephones which are waiting chiefly for the manufacture and installation of additional switching equipment and other needed plant facilities. However, during the year 1946 the Bell System alone, which operates 80 percent of the nation's telephones, added 3,264,000 new telephones to its network—a number equal to four-fifths of all the telephones serving the United Kingdom, the second largest

communications system in the world.

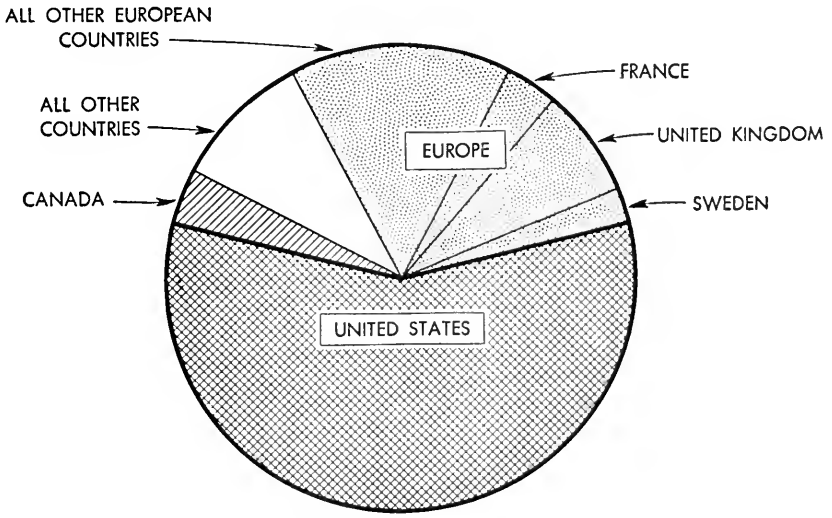
Among the 31,611,000 telephones serving the United States on January 1, 1947, the "dial tone" could be heard over no less than 18,700,000, which represent 58 percent of the dial-operated instruments estimated for the world. The telephones of America are interconnected by more than 116 million miles of wire, three-fifths of it underground and 95 percent of it in cables, and they can be

THE WORLD'S TELEPHONES BY CONTINENTAL AREAS
January 1, 1947 [1]

Areas	Government Systems	Private Companies	Total	Distribution	Per 100 Population	Automatic (or Dial)	
						Number (Included in Total)	Per Cent of Total Telephones
North America (less United States)	332,000	2,148,000	2,480,000	4.54%	3.98	1,422,000	57.34%
United States	—	31,611,000	31,611,000	57.90%	22.37	18,700,000	59.16%
South America	658,000	720,000	1,378,000	2.52%	1.36	963,000	69.88%
Europe	13,470,000	2,280,000	15,750,000	28.85%	2.65	9,600,000	60.95%
Asia	1,360,000	181,000	1,541,000	2.82%	0.13	590,000	38.29%
Africa	583,000	7,000	590,000	1.08%	0.32	380,000	64.41%
Oceania	1,166,000	84,000	1,250,000	2.29%	1.23	745,000	59.60%
World	17,569,000	37,031,000	54,600,000	100.00%	2.32	32,400,000	59.34%

[1] Partly estimated, all data having been adjusted to January 1, 1947 basis.

DISTRIBUTION OF THE WORLD'S TELEPHONES
January 1, 1947



TELEPHONE DEVELOPMENT OF THE WORLD, BY COUNTRIES, JANUARY 1, 1947

Countries	Number of Telephones				Automatic (or Dial)	
	Government Systems	Private Companies	Total	Per 100 Population	Number (included in Total)	Per Cent of Total Telephones
NORTH AMERICA:						
United States	—	31,611,000	31,611,000	22.37	18,700,000	59.16%
Canada	283,300	1,740,400	2,023,700	16.32	1,133,300	56.00%
Central America	30,700	22,300	53,000	0.55	19,000	35.85%
Mexico	3,000	222,000	225,000	0.98	154,822	68.81%
West Indies:						
Cuba	530	85,270	85,800	1.69	71,836	83.72%
Puerto Rico	1,022	27,043	28,065	1.31	13,880	49.46%
Trinidad and Tobago	145	10,442	10,587	1.88	6,792	64.15%
Other Places in the West Indies	13,300	16,100	29,400	0.33	22,040	74.97%
Other Places in North America	200	24,300	24,500	5.16	330	1.35%
SOUTH AMERICA:						
Argentina	540,000	50,000	590,000	4.05	430,000	72.88%
Bolivia	—	7,700	7,700	0.20	5,000	64.94%
Brazil	1,500	438,000	439,500	0.93	313,300	71.29%
Chile	—	113,200	113,200	2.07	75,007	66.26%
Colombia	34,100	21,600	55,700	0.54	16,000	28.73%
Ecuador	4,600	5,200	9,800	0.29	1,000	10.20%
Paraguay	4,400	—	4,400	0.37	3,700	84.09%
Peru	—	41,000	41,000	0.52	30,415	74.18%
Uruguay	68,400	1,600	70,000	3.02	51,051	72.93%
Venezuela	800	41,700	42,500	0.96	37,400	88.00%
Other Places in South America	4,200	—	4,200	0.68	133	3.17%
EUROPE:						
Austria	275,139	—	275,139	3.93	202,013	73.42%
Belgium	450,259	—	450,259	5.37	323,471	71.84%
Bulgaria	52,765	—	52,765	0.75	22,000	41.69%
Czechoslovakia	311,810	—	311,810	2.60	165,000	52.92%
Denmark	27,784 [4]	563,961	591,745	14.33	196,500	33.21%
Eire	57,174	—	57,174	1.94	32,808	57.38%

Finland	25,517	238,714	264,231	6.78	141,655	53.61%
France	1,997,335	—	1,997,335	4.93	1,321,089	66.14%
Greece [4]	1,000	57,700	58,700	0.78	57,700	98.30%
Hungary	79,010	—	79,010	0.82	55,047	69.67%
Netherlands	514,355	—	514,355	5.41	448,625	87.22%
Norway [1]	237,579	95,891	333,470	10.94	185,460	55.62%
Poland	169.821	—	169,821	0.70	110,000	64.77%
Portugal	32,284 *	72,185	104,469	1.26	43,588	41.72%
Romania	1,022	126,131	127,153	0.76	96,402	75.82%
Spain	—	477,866	477,866	1.75	333,751	69.84%
Sweden [2]	1,242,071	2,002	1,244,073	18.64	701.940	56.42%
Switzerland	697,589	—	697,589	15.57	635,000	91.03%
U.S.S.R. †	1,500,000	—	1,500,000	0.71	400,000	26.67%
United Kingdom [3]	3,976,936	—	3,976,936	8.43	2,639,204	66.36%
Other Places in Europe	1,600,000	650,000	2,250,000	1.72	1,350,000	60.00%
ASIA:						
British India	127,000	—	127,000	0.03	54,000	42.52%
China	78,827	150,000	228,827	0.05	140,000	61.18%
Japan [4]	990,874	—	990,874	1.27	303,592	30.64%
Turkey ‡	41,352	—	41,352	0.21	33,806	81.75%
Other Places in Asia	122,000	31,000	153,000	0.08	59,000	38.56%
AFRICA:						
Egypt [2]	95,303	—	95,303	0.40	68,128	71.49%
Morocco	34,694	7,000	41,694	0.42	27,440	65.81%
Union of South Africa	300,000	—	300,000	2.58	220,000	73.33%
Other Places in Africa	150,000	—	150,000	0.11	60,000	40.00%
OCEANIA:						
Australia [1]	827,862	—	827,862	11.22	489.246	59.10%
Hawaii	—	75,598	75,598	12.60	55,228	73.05%
New Zealand [4]	278,000	—	278,000	15.57	164,500	59.17%
Other Places in Oceania	16,600	8,400	25,000	0.03	6,000	24.00%

[1] June 30, 1945.
[2] January 1, 1946.
[3] March 31, 1946.
[4] March 31, 1947.

* Subscribers only.
† Including all Asiatic territory of the U.S.S.R.
‡ Including Turkey-in-Europe.

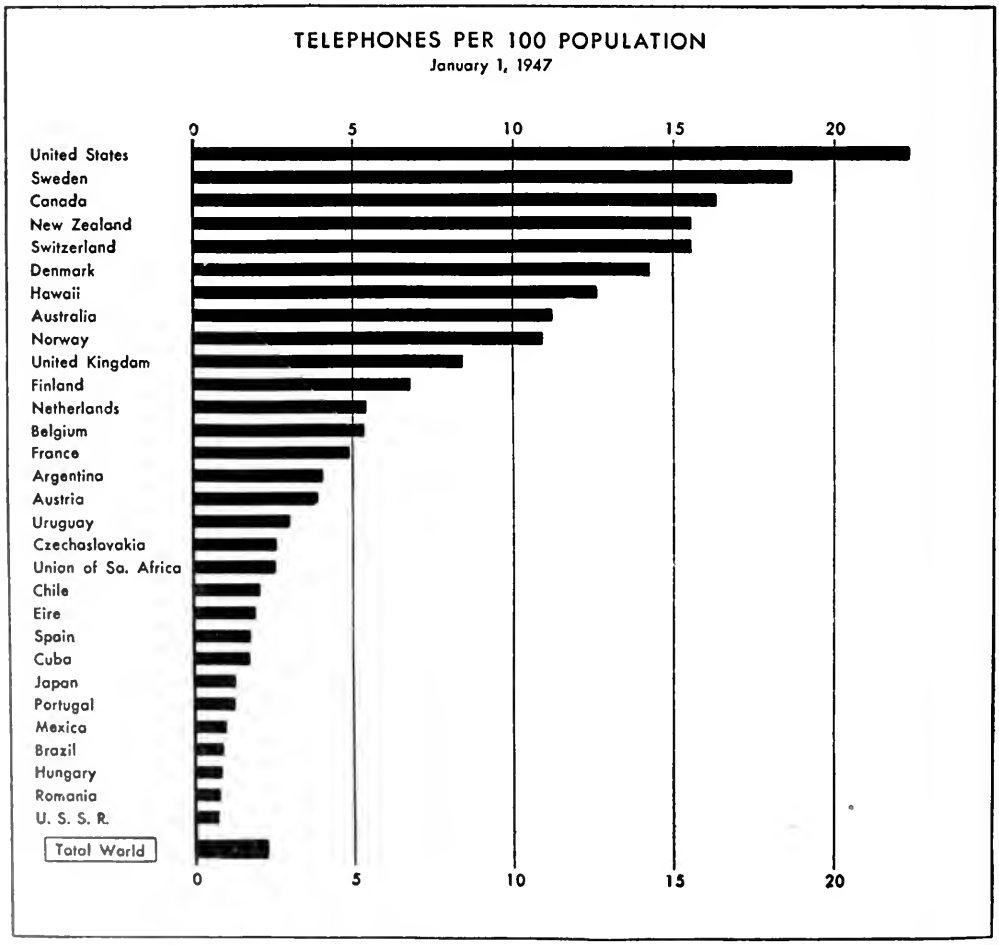
connected by radio telephone links to telephones on ships, railways, motor vehicles, and with those in 68 countries or territories overseas.

The tide of telephone calling in the United States during 1946 rose to a record high average of 128 million conversations each business day, so that the nation's voice channels were kept humming during the year by more than 42 billion telephone messages—or more than 300 completed conversations for each man, woman, and child in the nation. Fifty years ago, there was an average of only twelve telephone messages during the year for each person in the nation.

Ownership at the Start of 1947

GOVERNMENT-OWNED SYSTEMS in the world accounted for 17.6 million telephones, of which more than three-fourths were in the continent of Europe. Among those systems wholly or predominantly owned and operated by national governments, the largest eight * had in the aggregate some twelve million instruments

* The United Kingdom, France, the U.S.S.R., Sweden, Japan, Australia, Switzerland and the Netherlands.



TELEPHONE CONVERSATIONS AND TELEGRAMS[1]
Year 1946

Country	Number of Telephone Conversations	Number of Telegrams	Total Number of Wire Communications	Per Cent of Total Wire Communications		Wire Communications Per Capita		
				Telephone Conversations	Telegrams	Telephone Conversations	Telegrams	Total
Australia [2]	753,000,000	36,590,000	789,590,000	95.4	4.6	102.6	5.0	107.6
Belgium	370,000,000	7,782,000	377,782,000	97.9	2.1	44.2	0.9	45.1
Canada [3]	3,210,000,000	16,414,000	3,226,414,000	99.5	0.5	264.9	1.3	266.2
Denmark [3]	1,020,000,000	2,784,000	1,022,784,000	99.7	0.3	252.2	0.7	252.9
Egypt [3]	380,000,000	4,333,000	384,333,000	98.9	1.1	15.8	0.2	16.0
Eire	60,000,000	2,907,000	62,907,000	95.4	4.6	20.3	1.0	21.3
Finland	478,000,000	1,298,000	479,298,000	99.7	0.3	123.3	0.3	123.6
France	1,457,000,000	37,062,000	1,494,062,000	97.5	2.5	36.0	0.9	36.9
Japan	2,604,000,000	74,145,000	2,678,145,000	97.2	2.8	34.3	1.0	35.3
Norway [2]	463,000,000	7,897,000	470,897,000	98.3	1.7	152.3	2.6	154.9
Portugal	134,000,000	5,422,000	139,422,000	96.1	3.9	16.3	0.7	17.0
Romania	358,000,000	6,477,000	364,477,000	98.2	1.8	21.6	0.4	22.0
Sweden [3]	1,715,000,000	6,531,000	1,721,531,000	99.6	0.4	258.4	1.0	259.4
Switzerland	581,000,000	2,755,000	583,755,000	99.5	0.5	130.5	0.6	131.1
United States	42,280,000,000	211,000,000	42,491,000,000	99.5	0.5	301.2	1.5	302.7

[1] Telephone conversations represent completed local and toll or long distance messages. Telegrams include inland and outgoing international messages.
[2] Year ended June 30, 1945.
[3] Year ended December 31, 1945.

in service at the beginning of 1947, or one telephone for each group of thirty-four people. Of these eight government-owned systems—ranging down from four million telephones to one-half million telephones—Sweden has the highest telephone density with 18.64 telephones per 100 inhabitants, being second only to the United States.

Telephone Development by Leading Countries

THE LARGEST TELEPHONE network outside of the United States, that of the United Kingdom, is operated as a branch of the British Post Office. As of March 31, 1946, this administration reported 3,936,995 telephones, and the three "municipal" systems (serving the City of Hull and the Islands of Guernsey and Jersey) reported, at the beginning of that year, 39,941 telephones. During the summer of 1946 the United Kingdom passed the four million mark in the number of its telephones in service, or slightly more than seven percent of the world's total. When ranked according to the number of telephones serving each 100 of its population (8.43), it occupied tenth position among the countries of the world.

Among the communications systems of the world, the Canadian telephone system has risen to third place on the bases of both absolute size and number of telephones available to each group of 100 persons in the

TELEPHONE DEVELOPMENT OF LARGE CITIES, JANUARY 1, 1917

Country and City (or Exchange Area)	Estimated Population (City or Exchange Area)	Number of Telephones	Telephones per 100 Population
AUSTRALIA:			
Adelaide	374,000	48,001	12.83
Brisbane	382,000	53,804	14.08
Melbourne	1,206,000	192,187	15.94
Sydney	1,440,000	223,295	15.51
AUSTRIA:			
Graz	220,000	14,762	6.71
Linz	173,000	13,290	7.68
Vienna	1,538,000	137,327	8.93
BELGIUM:			
Antwerp	570,000	50,616	8.88
Brussels	925,000	148,360	16.04
Charleroi	270,000	21,277	7.88
Ghent	212,000	13,193	6.22
Liege	360,000	23,864	6.63
BRAZIL:			
Bello Horizonte	225,000	9,594	4.26
Nictheroy	160,000	7,944	4.97
Rio de Janeiro	2,070,000	159,076	7.68
Sao Paulo	1,466,000	88,348	6.03
CANADA:			
Hamilton	189,600	44,835	23.65
Montreal	1,198,000	265,447	22.16
Ottawa	252,000	66,018	26.20
Quebec	219,900	38,793	17.64
Toronto	903,100	298,911	33.10
Vancouver	371,000	103,544	27.91
CHILE:			
Santiago	1,055,000	62,199	5.90
Valparaiso	240,000	8,744	3.66
CHINA:			
Hong Kong	1,500,000	17,304	1.15
Peiping	1,700,000	24,130	1.42
Shanghai	4,000,000	94,317	2.36
Tientsin	1,400,000	17,557	1.25
NETHERLANDS:			
Amsterdam	798,000	78,262	9.81
Haarlem	197,000	16,188	8.22
The Hague	582,000	64,584	11.10
Rotterdam	706,000	50,545	7.16
Utrecht	200,000	17,537	8.77
NEW ZEALAND: [3]			
Auckland	265,000	41,524	15.67
Wellington	175,000	41,588	23.76
NORWAY: [1]			
Bergen	111,000	22,592	20.35
Oslo	435,000	96,423	22.17
PORTUGAL:			
Lisbon	781,000	46,930	6.01
Oporto	317,000	16,025	5.06
ROMANIA:			
Bucharest	1,017,000	69,959	6.88
SPAIN:			
Barcelona	1,129,000	73,314	6.49
Bilbao	218,000	16,518	7.58
Madrid	1,179,000	101,244	8.59
Seville	335,000	14,659	4.38
Valencia	556,000	16,627	2.99
Zaragoza	288,000	10,593	3.68
SWEDEN: [2]			
Göteborg	315,000	87,511	27.78
Malmö	171,000	40,993	23.97
Stockholm	834,000	325,765	39.06
SWITZERLAND:			
Basel	169,000	57,284	33.90
Bern	140,000	50,973	36.41
Geneva	125,000	44,196	35.36
Lausanne	102,000	29,057	28.49
Zurich	384,000	110,555	28.79

COLOMBIA: [2]			
Bogota	415,000	18,702	4.51
CUBA:			
Havana	873,000	61,169	7.01
DENMARK: [2]			
Copenhagen	950,000	265,451	27.94
EGYPT: [2]			
Cairo	1,500,000	28,921	1.93
EIRE:			
Dublin	507,000	32,808	6.47
FINLAND:			
Helsinki	394,000	80,761	20.50
Turku (Abo)	105,000	9,890	9.42
FRANCE:			
Bordeaux	254,000	29,118	11.46
Lille	189,000	19,862	10.51
Lyon	461,000	58,354	12.66
Marseille	636,000	51,602	8.10
Nantes	200,000	14,543	7.27
Nice	211,000	19,491	9.24
Paris	2,729,000	630,551	23.11
HUNGARY:			
Budapest	1,500,000	49,776	3.32
JAPAN:			
Kobe	445,000	13,416	3.01
Kyoto	917,000	51,427	5.61
Nagoya	721,000	19,434	2.70
Osaka	1,297,000	63,152	4.87
Tokio	3,820,000	119,806	3.14
Yokohama	709,000	7,949	1.12
MEXICO:			
Guadalajara	262,000	10,965	4.19
Mexico, D. F.	1,780,000	122,224	6.87
Monterrey	226,000	12,225	5.41
URUGUAY:			
Montevideo	710,000	51,051	7.19
UNITED STATES:			
New York	7,676,500	2,213,828	28.84
Chicago	3,675,000	1,322,411	35.98
Detroit	2,179,000	660,036	30.29
Philadelphia	2,018,000	558,050	27.65
Los Angeles	1,865,000	672,815	36.08
Cleveland	1,248,000	423,885	33.97
St. Louis	1,057,200	307,345	29.07
Pittsburgh	1,036,500	320,061	30.88
Baltimore	1,021,800	244,394	23.92
Total 9 exchange areas with more than one million population	21,777,000	6,722,825	30.87
Washington, D. C.	940,000	386,117	41.08
Milwaukee	837,200	244,092	29.16
San Francisco	830,500	369,365	44.48
Boston	721,800	253,735	35.15
Seattle	640,000	215,751	33.71
Houston	583,300	170,718	29.27
Indianapolis	504,000	163,442	32.43
Total 15 exchange areas with 500,000 to one million population	9,954,900	3,281,023	32.96
Portland (Oregon)	484,000	154,316	31.88
Denver	400,000	150,012	37.50
St. Paul	348,000	122,531	35.21
Omaha	283,000	95,305	33.68
Hartford	282,900	101,739	35.96
Oklahoma City	266,700	87,186	32.69
Richmond	256,000	82,981	32.41
Total 38 exchange areas with 200,000 to 500,000 population	11,730,500	3,346,822	28.53
Total 62 exchange areas with more than 200,000 population	43,462,400	13,350,670	30.72

NOTE: There are shown, for purposes of comparison with cities in other countries, the total development of all cities in the United States in certain population groups, and the development of certain representative cities within each of such groups.

[1] June 30, 1945. [2] January 1, 1946. [3] March 31, 1947.

Dominion. In regard to the number of telephone messages per capita, it is second to that of the United States, with 265 completed conversations per year for each inhabitant. Of Canada's 2,023,700 telephones at the beginning of 1947, all but 15 percent were operated by private companies.

A total of 1,997,335 telephones within its borders makes France the fourth largest telephone system in the world. More than 31 percent of the French telephones are located within the Paris exchange area. Today, two thirds of France's telephones are dial operated, and Frenchmen in the year 1946 picked up their telephones and conversed almost 1.5 billion times, for an average of 36 calls per capita.

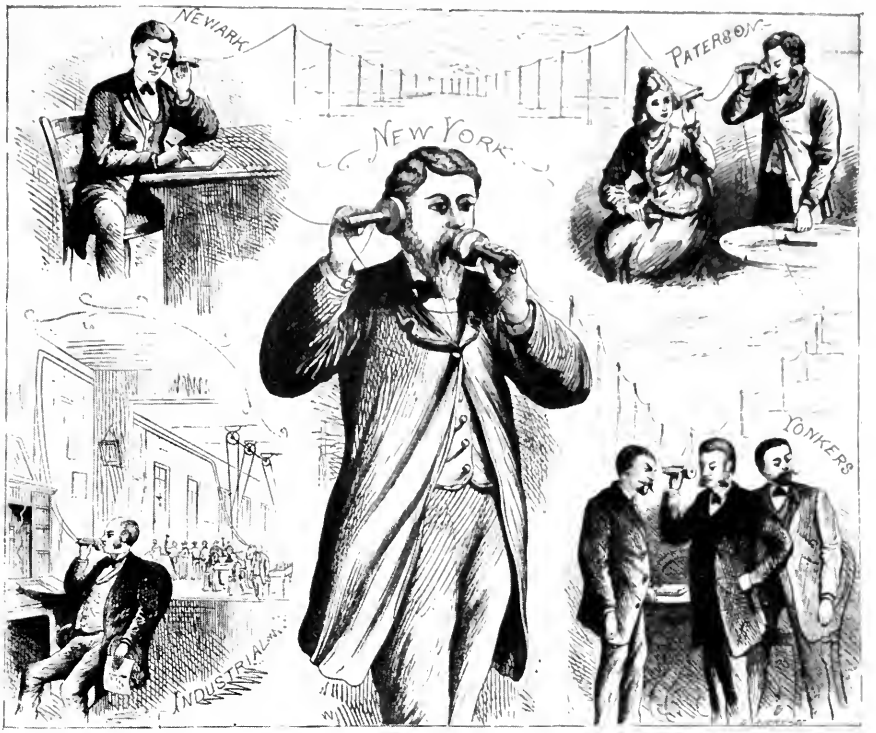
Fifth in point of absolute size, second in telephone density, is the Swedish telephone system. Twenty-six percent of the present Swedish system is located within the Stockholm area. Of Sweden's 1,244,073 telephones at the beginning of 1946, 56 percent were of the dial type. During the year 1945, more than 1.7 billion telephone messages were routed through the Swedish network, so that, on the average, each individual in that kingdom completed 258 telephone conversations during the year.

Among the South American republics, Argentina retained its leadership with a total of 590,000 instruments in service for a development of 4.05 telephones per 100 inhabitants at the beginning of 1947. Brazil at the same time had 439,500 telephones in service, so that together these two countries accounted for almost three-quarters of all the telephones in South America. In point of telephone density, Uruguay ranked second in South America, since each 100 people in that republic had more than 3 telephones available to them.

Telephone Development in Cities

Among all the communities of the world (exclusive of those in the United States) having a population greater than 50,000, there are less than 100 cities whose telephone density is greater than *ten* telephones for every 100 of the population; yet here at home there are almost 200 cities within this category whose telephone density exceeds *twenty* telephones per 100 population. In all communities of less than 50,000 population, the United States shows a total telephone development of more than 17 per 100 inhabitants. In this respect, Sweden, Switzerland, and Canada rank next in the order named with developments of 14, 11 and 10, respectively. No one city in the United States embraces more than seven percent of the country's telephones. Yet, the three large urban centers of New York, Chicago and Los Angeles together had far more telephones than the largest telephone system in the world outside of the United States.

A telephone network larger than that of Norway serves the 831 thousand people of the San Francisco exchange area, so that the measure of telephone development for this metropolis is 44.48 telephones for each 100 people, a figure surpassing that of any other large metropolitan telephone exchange area in the world. Two telephones for 1.35 billion people in the world of 1876! Almost one telephone for every *two* people in the San Francisco of 1947!



The New Bell Telephone

From the *Scientific American* of October 6, 1877

Our large engraving . . . affords an excellent idea of how the instrument is used, and also of about the extent of circuit over which it is known to be capable of successful operation. We suppose the closed wire circuit to extend from New York to Newark, thence to Paterson and Yonkers, and back to New York, a distance of about 50 miles air line, or some 70 miles by railway. The figure marked New York may be considered as a public speaker delivering a lecture to be heard in the towns mentioned. He talks into one telephone while he holds another to his ear, in order, for example, to hear the applause, etc., of his auditory; or he may be maintaining a discussion or debate, and he then hears his adversary's replies or interruptions. Now, at Newark there is simply a reporter, who takes down the speech phonographically; the words pass on through that telephone and reach Paterson. Here we show two persons, each with a telephone, the two instruments being connected. . . . In Yonkers we show three persons listening to a single instrument, which may be done in a very quiet room. Finally, in a side sketch we show how the telephone is arranged to serve as a speaking trumpet between office and shop in a factory. . . . The telephone has advanced considerably beyond the status of a "beautiful scientific toy," which many hastily pronounced it. . . .

A Tribute to an Outstanding Leader Who Four Decades and More Ago Guided the Development and Research Activities of the Bell System in Its Most Critical Period

Hammond V. Hayes: 1860-1947

Roger B. Hill and Thomas Shaw

With an introductory note by

William H. Harrison

The death of Hammond Vinton Hayes last March severed another of the few remaining ties with the founding fathers of telephony. He was a leader among the company of men who, combining their practical skill with vision for the future, took Bell's concept and instruments and went on to build many of the foundations of the telephone system and telephone service as we know them today. In their approach to their task this group also laid a basis for much of the progress later achieved by others. Mr. Hayes's own contributions to the telephone art were great: he provided a high calibre of leadership, which expressed itself in his personal relations with his staff members and in his creation of an able organization; and through his inventive and engineering skill he solved, or guided the solution of, problems which were stifling the growth of the service. How Mr. Hayes brought these accomplishments about, and what were their consequences, Messrs. Hill and Shaw relate in the following pages. The period covered was a critical one in telephone history, and men of long service in the Bell System will read the narrative with a lively recollection of difficulties overcome, of milestones passed with invigorated stride. Younger members will get from it perhaps a better understanding of what it must have been like to try to serve the public during the first twenty years or so after the telephone first spoke—and a realization that today's problems can be solved even as were those heavier ones of half a century ago. It is a stimulating story of ability, of perseverance, of obstacles surpassed and triumphs won, told in tribute to one of the outstanding leaders in telephone history.

WILLIAM H. HARRISON
Vice President, A. T. & T. Co.

Hammond Vinton Hayes

On March 23, 1947, the Boston Sunday papers carried notices of the death of Hammond V. Hayes at his Beacon Street residence on the previous day. Mentioning that prior to his retirement in 1930 he had been president of the Submarine Signal Corporation, they also stated that earlier in his life he had been in charge of engineering work for the American Bell Telephone Company and the American Telephone and Telegraph Company.

To many who have played important roles in the development of the telephone art, however, the name of Hammond Vinton Hayes will mean far more than such a casual reference implies. Out of the flood of returning memories, Mr. Hayes will emerge as the outstanding leader who guided the research and development activities of the Bell System through what was perhaps its most critical period—from 1885 to 1907—through twenty-two years when serious obstacles to success were being encountered at a rate far higher than during any equal period since, and yet a period when the miles of exchange wire in the Bell System increased over sixty-fold.

To guide the technical development of the telephone system during these years of stress, a man of exceptional caliber was required. Such a man was found in Mr. Hayes. Endowed with persistence, determination, and ability from a long line of New England ancestry, and possess-

ing an excellent technical training and an innate keenness of mind, he seemed instinctively able to select the most suitable assistants and to inspire them with enthusiasm for the tasks he assigned. His interest in every project continued to its culmination, and he never wavered in his solicitude for the progress and well being of his associates. He seemed to have been prepared by fate for the existing need.

Family Background

ABOUT THE YEAR 1680, during the early colonial period, a certain John Hayes arrived from Scotland and settled in Dover, New Hampshire. Hammond V. Hayes was one of his direct descendants of the seventh generation. His father, William Allen Hayes, was born in South Berwick, Maine, and on a trip through the West as a young man met Elizabeth Vinton, daughter of General David Hammond Vinton, and married her in Madison, Wisconsin. The two children of this marriage, Hammond Vinton and William Allen, were born in Madison on August 28, 1860, and June 11, 1862, respectively.

Returning to New England in 1864, the family settled in Cambridge, Mass. During the years that followed, Mr. Hayes's father held many important positions, among them treasurer of the Atlantic and Pacific Railway Company and of the Boston, Newport, and New York Steamship Company. In the meantime, his two sons were attending schools in Cambridge and Boston. Hammond V. Hayes was graduated from the Boston Latin School, and from Harvard University in the class of 1883. He then studied at Massachusetts Institute of Technology, and took graduate work at Harvard, where he received his Master's degree and the second Doctor's degree in Physics to be awarded by Harvard. He never married. On December 7, 1885, he joined the American Bell Telephone Company in Boston—at that time the parent company of the Bell System—and was placed in charge of the recently created Mechanical Department.

Rapid and Effective Technical Development Needed

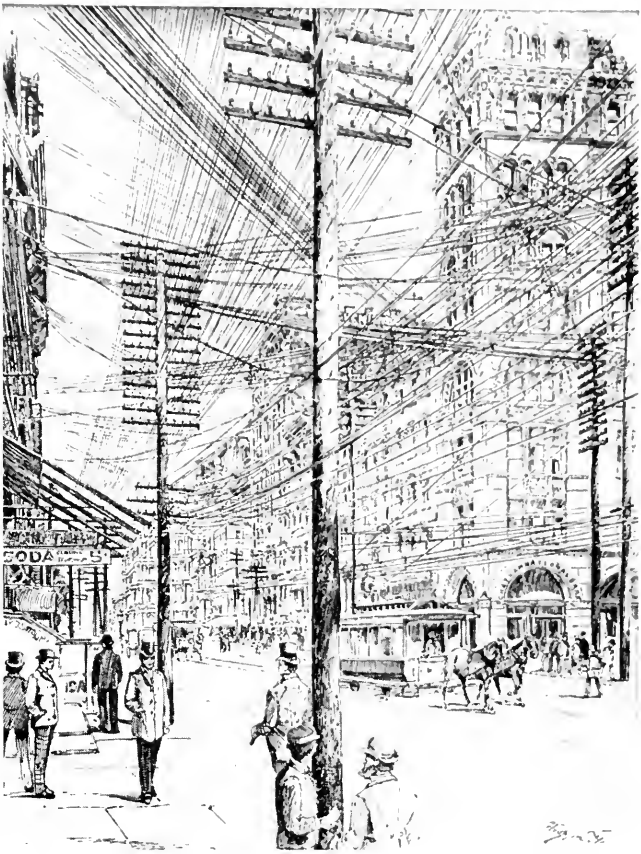
FOR THOSE familiar chiefly with the telephone system of the present day, with its multi-channel carrier systems that by open wires, cable, and radio carry the voice completely around the world, it is difficult to realize the crude state of telephone communication in 1885, when Mr. Hayes took over responsibility for its technical growth. Not only was telephony a completely new art, but the entire electrical industry was in its infancy. The telegraph was well established, but the Brush arc light and the Edison incandescent electric lamp were only just beginning to be used, and they were of no assistance in the development of the telephone art. To a large extent, the entire theory of telephone transmission was yet to be developed.

In the telephone industry itself, progress was being made in installing telephones and the exchanges needed to interconnect them, but the impediments were burdensome.

At each telephone there had to be batteries to supply talking current, and a magneto ringer for signaling the operator. The batteries in par-

ticular required continual and expensive maintenance, since their useful life was relatively short.

The use a subscriber got from his telephone was definitely restricted. Anything approaching satisfactory talking conditions could not be obtained beyond a very limited radius. The currents that could be handled in the telephone transmitter of that time were small, and in their passage over the line—for the most part a single wire with ground return—were not only soon dissipated by the losses, but were seriously interfered with by innumerable noises, and often by crosstalk from other circuits on the same line.



Overhead wires on lower Broadway, New York, in 1890

Switching facilities were very inadequate. When the subscribers finished talking, they had to "ring off" to notify the operator to take down the connection. When they neglected to do this, as they frequently did, the operator had to listen in on the line to find out whether or not it should be disconnected.

Lacking satisfactory cable and consisting for the most part of iron wire carried on roof tops and on poles down city streets, the distributing system of the time provided no suitable foundation on which a permanent and expanding system could satisfactorily be built.

Only rapid and effective technical development could transform this inchoate but rapidly growing system into the soundly based, scientifically designed structure which it later became.

It was this assignment which Mr. Hayes took over.

Early Organization

UNTIL 1883, the technical work of the American Bell Telephone Company had been carried on by two groups: the Electrical and Patent Department, which studied available patents and new apparatus, and performed all the engineering functions being carried on; and the Stock and

HEADQUARTERS TECHNICAL STAFF
AMERICAN BELL TELEPHONE COMPANY
DECEMBER 31, 1885
29 EMPLOYEES

ELECTRICAL AND PATENT DEPT.	MECHANICAL AND TESTING DEPT. (H.V. HAYES IN CHARGE)	STOCK AND PACKING DEPT.
SPECIAL DEVELOPMENT WORK: E. BERLINER W. W. JACQUES J. H. FLANNIGAN G. H. E. TROUVELOT PATENTS: T. D. LOCKWOOD V. M. BERTHOLD G. W. PIERCE D. E. RICHARDS F. J. SCHWARTZ W. B. VANSIZE SPECIAL WORK W. A. HOVEY JOSEPH LYONS	GENERAL EXPERIMENTAL WORK: MORGAN BROOKS E. H. LYON INSTRUMENT INSPECTION: W. L. RICHARDS THOS. F. MAGUIRE G. K. THOMPSON J. B. WILKINS SHOP: H. R. MASON W. P. RICHARDS G. W. THOMPSON CLERICAL: F. E. DONOHOE OFFICE BOY: F. C. BROWN	J. R. QUICK A. F. HALL T. FRANCIS MAGUIRE F. MARTIN H. G. MCKENNEY

Testing Department—its function indicated by the name.

In 1883, an Experimental Shop was organized to supplement the activities of the Electrical and Patent Department. In June, 1884, its name was changed to the Mechanical Department—although today the functions it was to perform would be called development and research—and Ezra T. Gilliland was put in charge. Mr. Gilliland resigned in November, 1885, when the department was only about a year old, and thus the structure and effectiveness it later achieved were derived from the contributions of Mr. Hayes, who took control of it the following month.

This Mechanical Department of which Mr. Hayes took charge was the first formal department in the continuous chain of research and development organizations of which the present representative is Bell Telephone Laboratories. During the following forty years, it went through many metamorphoses, changing its name, adding or dropping functions, and shifting its organizational plan; but throughout these years and ever since, it has been responsible for developing the apparatus and systems needed to provide the best telephone service possible in the existing state of the art, and through all the later years for carrying on research to discover and correlate basic laws and theory.

The first major modification of the engineering organization after Mr. Hayes assumed control of the Mechanical Department was in 1891, when an Engineers Department under Joseph P. Davis was formed to standardize plant construction and operating methods. In 1891, therefore, the two technical departments were the Engineers Department under J. P. Davis, and the Mechanical Department under Mr. Hayes. Considerably Mr. Hayes's senior both in age and Bell System experience, Mr. Davis was placed nominally in charge of both the Engineers and the Mechanical Departments in 1894, but Mr. Hayes continued to guide the Mechanical Department independently as before.

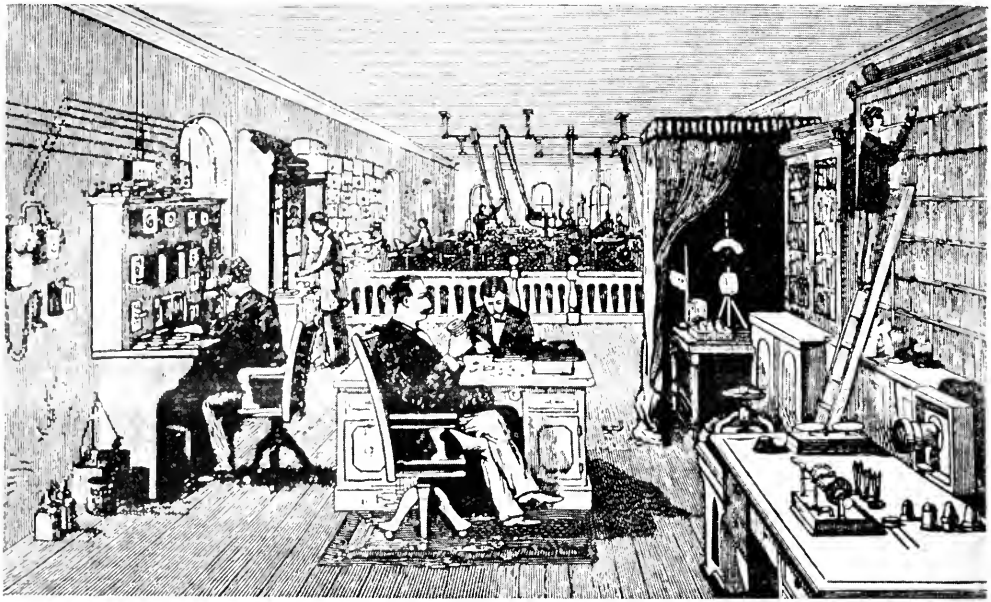
By 1902, Mr. Davis was in poor health and unable to continue active direction of the Engineers Department. As a result, the Engineers and the Mechanical Departments were merged into a single organization called the Engineering Department and placed under a three-man committee, which nominally reported to Davis. Mr. Hayes was one of this directing committee, and was responsible for preparing the annual reports of the Engineering Department for Mr. Davis during this period. On January 1, 1905, however, Mr. Davis resigned, and at this time Hayes was made Chief Engineer and placed in charge of the combined Engineering Department.

Opposite: Organization chart of the headquarters technical staff of the American Bell Telephone Company in 1885

The New Parent Company

In the meantime, other changes had been taking place.

The year before Mr. Hayes joined the Bell System, an experimental metallic circuit, using hard-drawn copper wire, had been built between



The laboratory of the Mechanical Department, at 101 Milk Street, Boston, in 1884; from an old wood engraving published in the "Scientific American"

Boston and New York. This was the Bell System's first long distance circuit. Transmission over it was good enough, and optimism was strong enough, to give hope for the attainment of even greater distances with improvements that seemed possible in the near future.

To provide for the extensive long distance business that could now be foreseen, the American Telephone and Telegraph Company, a subsidiary of the American Bell Telephone Company, was incorporated in 1885 to construct and operate long distance lines. Its headquarters were in New York City, and it built up its own Engineering Department to carry out its various projects.

In 1899, a reorganization was carried out in which the American Telephone and Telegraph Company absorbed the American Bell Telephone Company and became the parent company. No change was made in the engineering organizations at this time. The parent company's Engineering Department remained in Boston and the Long Lines Engineering Department in New York. Since the American Telephone and Telegraph Company was now the parent company, Mr. Hayes was Chief Engineer of the American Telephone and Telegraph Company when he took charge of the combined Engineering Department in 1905.

Putting Wires in Cables

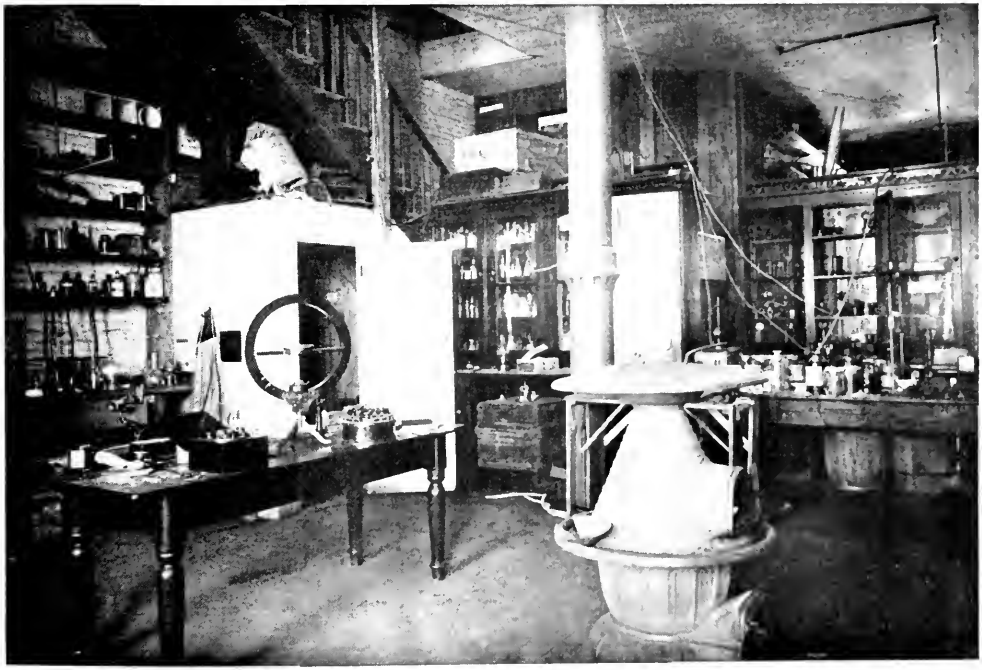
For some years before Mr. Hayes joined the Bell System, there had been need in certain places for a more compact transmission system than the open-wire line. The use of insulated wires in a protecting cover was the sort of thing required, and as early as 1879 cables had been placed over the Brooklyn Bridge. These were

single-wire ground-return circuits and had the difficulties inherent in this type of circuit superimposed on the many other difficulties of cable operation. All of the cables, moreover, for the next eight or nine years employed wires insulated with rubber or gutta-percha, or with cotton impregnated with a moisture-proofing compound. They were all very unsatisfactory because of their high electrostatic capacitance, and could be used only over very short distances.

By the year 1887, the need in the large cities for placing the wires under ground in metallic-circuit cables had become so pressing that a group of telephone executives and engineers was called together by the parent company to make a thorough study of the requirements of the Bell operating companies and to develop improved types of cables to meet these requirements. This group, called the Cable Committee, met at intervals over a period of years, and Mr. Hayes was one of its members.

Specifications resulting from the 1887 conference called for a cable of 18-gauge twisted-pair conductors, each with two wrappings of dry cotton. The spaces in the core and between the core and lead pipe were filled with paraffin or a resinous compound. The electrostatic capacitance was not to exceed .20 microfarad per mile, each wire tested against all others grounded.

During the year 1888, J. A. Barrett, of the long distance company, and W. D. Sargent, of the New York and New Jersey Telephone Company,



The laboratory of the Mechanical Department at 141 Pearl Street, Boston, in 1886

in a long series of experiments demonstrated the advantages of paper as cable insulation. As the result of trials of this new type of insulation, specifications were issued by the Cable Committee in 1891 for a dry-core 19-gauge twisted-pair cable insulated with manila paper, and with a maximum electrostatic capacitance of .085 microfarad per mile. In the conference specifications issued by the American Bell Telephone Company in 1892, the electrostatic capacitance was reduced to .080 microfarad per mile. This cable furnished the answer to the underground problem, permitting the wholesale replacement of open wires in the cities, and making it possible, for the first time, to engineer the telephone plant on a systematic and economical basis.

During the years that followed, improvements in the methods of cable manufacture permitted the number of pairs of 19-gauge wires that could be contained in a full-size cable to be increased from 100, in 1892, to 300, in 1901. In this latter year, improvements in the instruments and apparatus had made it possible to begin extensive use of 22-gauge cable in the exchange plant. By 1902, 600-pair 22-gauge cable had been made available to the operating companies of the Bell System.

Early in the year 1898, Mr. Hayes's department began work on the development of cables suitable for toll operation, to permit the long distance circuits entering large cities to be placed under ground, thus avoiding frequent service interruption by storms. Since the standard 19-gauge cable was not good enough for this service, and since loading had not yet been invented, it was necessary to employ much larger conductors, and also in some instances lower capacitance cable construction. The earliest of these new cables was installed between Boston and Lynn in 1898. During this and the following years, other cables employing 16-, 14-, or 13-gauge conductors were installed in the Boston and New York metropolitan areas, and the use of still larger conductors received serious consideration.

The development of paper-insulated cable carried out under direction of the Cable Committee in the years following 1887 was of tremendous value to the Bell System. Besides permitting the elimination of tall multi-armed pole lines and roof-mounted racks that enmeshed the larger cities, it enormously decreased inductive disturbances from outside the cable, avoided disruption of open-wire lines by sleet storms, and opened the door to more economical construction for long-distance circuits.

Improved Transmitters

Although cables tended to give quieter circuits by eliminating outside interference, their losses were higher than those of open-wire lines, and thus the need for higher speech volumes at the telephone transmitter became greater than ever.

In Bell's original transmitter, the voice voltages were generated electromagnetically, and only the power of the voice was available for their production. The discovery of microphonic action, and the development in 1878 of the Blake transmitter based on this discovery, greatly increased transmitter power. With

Roof-top construction in down-town New York in 1888

the microphone, transmitter power is supplied by a battery, and the microphonic contact acts as a valve to release more or less power to the line in response to the voice waves. No longer were the electrical signals limited to the small amount of power in the speech waves. Although a great improvement in this respect compared to the electro-magnetic transmitter, the Blake transmitter was still strictly limited in output because it employed only a single contact.

The discovery by Hunnings that microphonic action could be obtained between masses of granular carbon suggested an avenue to larger transmitter outputs, since with many contacts in place of a single one, more current could be handled by the transmitter. Attempts to utilize this discovery were unsuccessful for several years, since no way could be found to prevent the carbon particles from packing together and making the transmitter inoperative.

This difficulty was overcome by the invention, in 1890, by Anthony C. White of Mr. Hayes's staff of the "solid-back" transmitter. This instrument used a relatively small amount of granular carbon in a carbon chamber, or "button," so contrived that the motion of an electrode controlled by the diaphragm kept the granules agitated sufficiently to prevent them from forming a compact mass. This instrument was called the solid-back transmitter, since the rear electrode that made contact with the granular carbon was fixed in position. It was a much more powerful instrument than the solid-electrode Blake transmitter which it superseded. With numerous improvements, this basic design remained in use until it was replaced by the modern handset.

Developing a Common Battery

While the microphonic transmitters gave marked improvement in transmission, the local batteries that had been installed to supply them with current proved very expensive to maintain. What was desired was a single large battery at the central office that would supply all the subscribers, and although this idea was not new, no satisfactory way of applying such a battery had been found. A single battery supplying all the lines tends to couple all the lines together and to give excessive crosstalk, and no satisfactory way around the difficulty had been found.

Work seeking a common-battery system was started in the Mechanical Department in 1889. A large amount of experimental effort by Mr. Hayes and his staff was required, since it was desired to use the common battery for signaling as well as talking so as to make magneto generators at the subscribers' premises also unnecessary.

The fundamental problem of avoiding crosstalk was solved by Mr. Hayes's invention of the repeating-coil system of battery supply, which in improved form has been in universal use in the Bell System common-battery switchboards since that time.

With the common-battery system, both the batteries to furnish transmitter current and the magneto generators for signaling the operator were done away with at subscribers' stations, since the new system was so arranged that the operator could be signaled merely by removing the receiver from the hook. This closed the line circuit and, through a relay at the switchboard, caused a tiny electric lamp in front of the operator to glow. Lamps were also introduced as supervisory signals in the cord circuits, giving the operator at all times a visual indication of the status of the connection and making it unnecessary for her to listen in or disturb the service in any way.

The immediate advantages of the common-battery system, to which C. E. Scribner, J. J. Carty, and several other inventors also made important contributions, were a great improvement in the speed and quality of service, and a very large reduction in maintenance expense. It was one of the outstanding events in switchboard progress, and in the years to follow it opened the way to many additional improvements that would have been difficult or impossible without it.

The first common-battery board, installed at Lexington, Mass., in 1893, was a non-multiple board. The first multiple board with common battery for both talking and signaling, and employing lamps for line and supervisory signals, was installed at Louisville, Kentucky, in 1897. This type of board became known as the No. 1 relay board, and was widely used in large exchanges. By the early 1900s, common-battery relay boards had been installed in most of the larger cities throughout the United States.

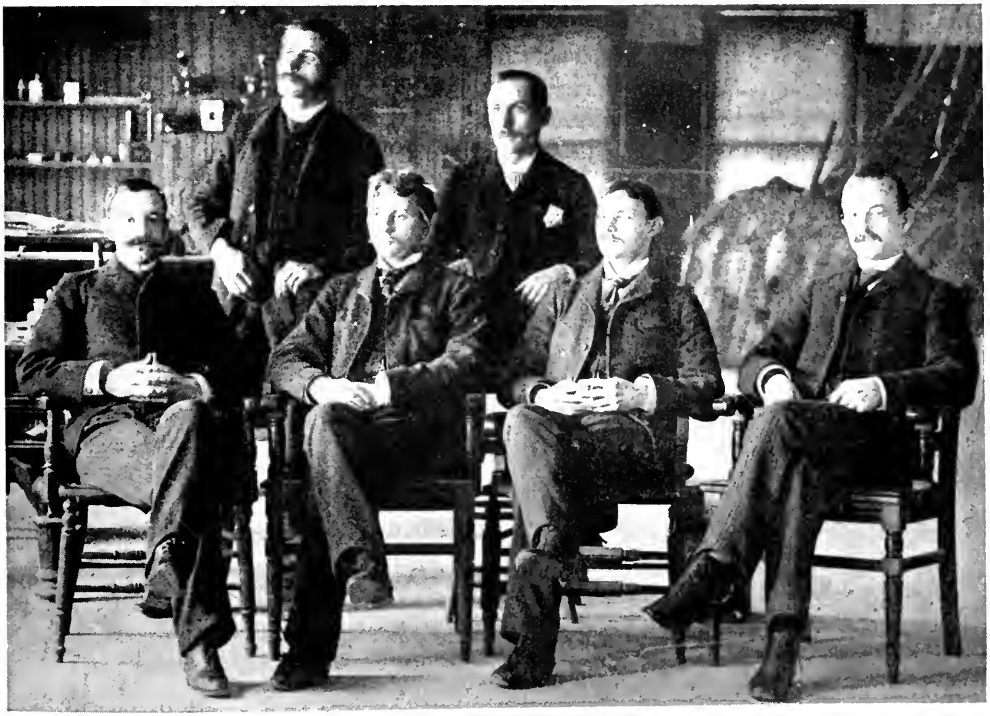
Since the highly ingenious split repeating coil employed in the common-battery switchboard and the circuit arrangement used with it were largely the personal contributions of Mr. Hayes, the method of common-battery supply used in the Bell Sys-

tem has generally been referred to in textbooks as the "Hayes System". Besides recognizing the many advantages of the system, Mr. Hayes continuously sponsored its general application and followed its operating successes. In 1895 he collected statistics showing that with common battery the instrument troubles were only one fourth as frequent as with the magneto system, and that, as a result, subscriber stations would require inspection only at infrequent intervals. The following year he estimated that with the common-battery system, the average speed of operation would be increased by forty percent, due to automatic signaling; and that the cost of battery maintenance would be reduced by seventy-five percent, due to the centralized battery. He also pointed out the advantages the system offered for registering calls by meter, for the application of coin-box service, and for the extensive introduction of private branch exchanges.

Open-wire Transposition

ANOTHER DEVELOPMENT to which Mr. Hayes's department made outstanding contributions was the design of transposition systems for open-wire lines.

In 1886 the first line of the newly formed long distance company was completed between New York and Philadelphia. Originally it carried



A group of Mechanical Department engineers at 127 Purchase Street, Boston, in 1889. Seated, W. L. Richards, H. D. Sears, Chauncey Smith, Jr., W. J. Hopkins; standing, E. H. Lyon, Anthony C. White

twelve metallic circuits of hard-drawn copper wires—the first instance of a large number of metallic circuits being carried on the same pole line. Tests soon showed that the crosstalk was as serious as it had been with the grounded circuits previously employed. This difficulty was overcome after months of hard work by J. A. Barrett, consulting engineer employed by the long distance company. Out of this work of Barrett's came the ABC system of transpositions—the first to come into general use. Although employed for many years, it was found to be inadequate as the business grew, and in 1898 was replaced by the so-called Standard or four-arm system. During 1904, an elaborate series of measurements of direct capacitances was made by E. H. Colpitts of Mr. Hayes's staff upon which rested much of the work of transposition design that was done in succeeding years.

Adoption of Coil Loading

Of the many transmission improvements made during the Hayes period, one of outstanding importance was the adoption of loading.

In the late 1880s and early 1890s, mathematical studies by Vaschy and Heaviside had indicated that it should be possible to improve transmission over a telephone line by artificially increasing the distributed inductance. They had also speculated on the possibility of approximating the beneficial effects of uniformly distributed inductance by inserting low-resistance inductance coils at intervals along the line. Rules for spacing the coils, however, were not worked out, nor were suitable types of coils developed.

In 1894, when transmission over long open-wire lines was being seriously impaired by the (non-loaded) entrance cables at their terminals, theoretical studies by John Stone Stone, of Mr. Hayes's staff, led to the proposal to replace them by continuously loaded cable designed to match the impedance of the open-wire lines. A specific design for such a "bi-metallic wire" cable resulted in a patent to Stone in 1897. Early in 1898, Mr. Hayes obtained an appropriation to cover further research and development of this type of cable for general underground use. The following year, shortly before Mr. Stone resigned, Mr. Hayes transferred responsibility for this research to Dr. George A. Campbell—who had joined his staff in the Fall of 1897.

Starting in February, 1899, Campbell's approach quickly convinced him that there would be substantial advantages in concentrating on coil loading instead of continuous loading. Work on continuous loading was accordingly dropped, and a comprehensive solution of the fundamentally important problem of coil spacing was soon reached. His theory was experimentally verified in an extensive series of laboratory tests on reels of actual cable in September, 1899. E. H. Colpitts assisted Campbell in these experiments, and subsequently made important contributions in many other phases of the development work.

The development work which followed the 1899 laboratory tests culminated in successful installations of

A group of instrument inspectors and members of the Stock and Packing Department at 127 Purchase Street in 1889: G. K. Thompson, Frank Martin, J. B. Wilkins, A. M. Dittmer, John Daly, J. W. O'Donnell, A. F. Hall

experimental types of solenoidal air-core loading coils on two 24-mile cable circuits in the Boston exchange area, completed May 18, 1900, and on a 670-mile, 104-mil, open-wire line completed July 2, 1900. After an adequate test period, the experimental loaded circuits were used in regular commercial service for several months.

Shortly before the installation of the experimental cable loading, the parent Bell company learned that Professor M. I. Pupin, of Columbia University, had independently worked out a theoretical solution of the coil loading problem. On June 19, 1900, two United States patents were issued to Professor Pupin. The conflicting claims of the Pupin and Campbell applications resulted in extended interference proceedings which ended, on April 6, 1904, in an award to Pupin on the basis of two weeks' priority in disclosure. Before the interference action had gone far, Pupin's rights in the invention were purchased to protect the parent company's interest whichever way the case might be decided.

Although the success of the 1900 trial installations quickly built up a substantial demand for loading, the commercial applications had to be deferred pending the development of satisfactory loading coils. Priority was given to open-wire loading, and by April, 1901, a very satisfactory toroidal type iron-wire core design

had been developed by H. S. Warren of Mr. Hayes's staff. This coil remained standard for about ten years, when a redesign became necessary because of the development of phantom-group loading.

Manufacturing difficulties that delayed the initial use of this design were solved in time to permit the opening of service on an existing 165-mil line between New York and Chicago in November, 1901. In May, 1902, commercial service was inaugurated on three 104-mil loaded open-wire lines between Philadelphia and Chicago. Experience gained in developing open-wire loading coils permitted the use of satisfactory toroidal type loading coils on the first commercial loaded cable project, a 19-gauge underground cable between New York City and Newark, N. J., completed in August, 1902. Prior to the invention of loading, a relatively expensive 13-gauge non-loaded cable had been planned for this route. Thus from the very beginning the use of loading yielded large economies in the cable plant of the metropolitan areas.

SINCE COIL-LOADED LINES completely suppress the transmission of frequencies above the cut-off frequency, which is a function of the coil inductance and spacing, and since the cost of loading is related to the cut-off frequency, a very important phase of the early development work was that of determining the minimum cut-off frequency that would be satisfactory. The 1899 laboratory tests carried the cut-off up to 11,000 cycles, but for the early commercial open-wire loading the cut-off frequency was reduced to 4100 cycles. Experience with these circuits and further laboratory tests finally resulted in 1904 in the adoption of 2300 cycles as the initial standard cut-off frequency. This standard so well met the early transmission service needs that the first increase in standard cut-off frequency did not occur until 1918.

The early applications of loading to open-wire lines were beset with many difficulties that could not be solved by theoretical studies or laboratory experiments, including the insulating properties of available line insulators, lightning protection devices, and the coördination of the coil-spacing and line transposition systems. Thus it happened that the final standard practice for loading 104-mil lines did not evolve until 1905. Generally satisfactory performance of loading on 165-mil lines was not obtained until the development of better line insulation about 1910.

The commercial exploitation of loaded cables went forward rapidly after the installation between Newark and New York, and resulted by 1904 in the adoption of loading-system standards that remained in good standing for two decades. A cable was installed between Boston and Worcester in 1904, and between New York and Philadelphia and New York and New Haven in 1906. Before the end of 1907 about 60,000 loading coils had been installed on some 86,000 miles of cable circuit.

DURING THE YEAR 1904, the commercial use of open-wire phantom circuits was made possible through the development of the 37A phantom circuit repeating coil, designed by H. S. Warren and described in a circular

issued to the Associated Companies in April of that year. The creation of an additional or phantom circuit from two physical circuits had occupied the attention of telephone engineers for many years, but the solution had been delayed until the development of Mr. Warren's toroidal coil—which used winding machinery developed for loading coils.

Part of the testing laboratory at 127 Purchase Street in 1889

The First Repeater

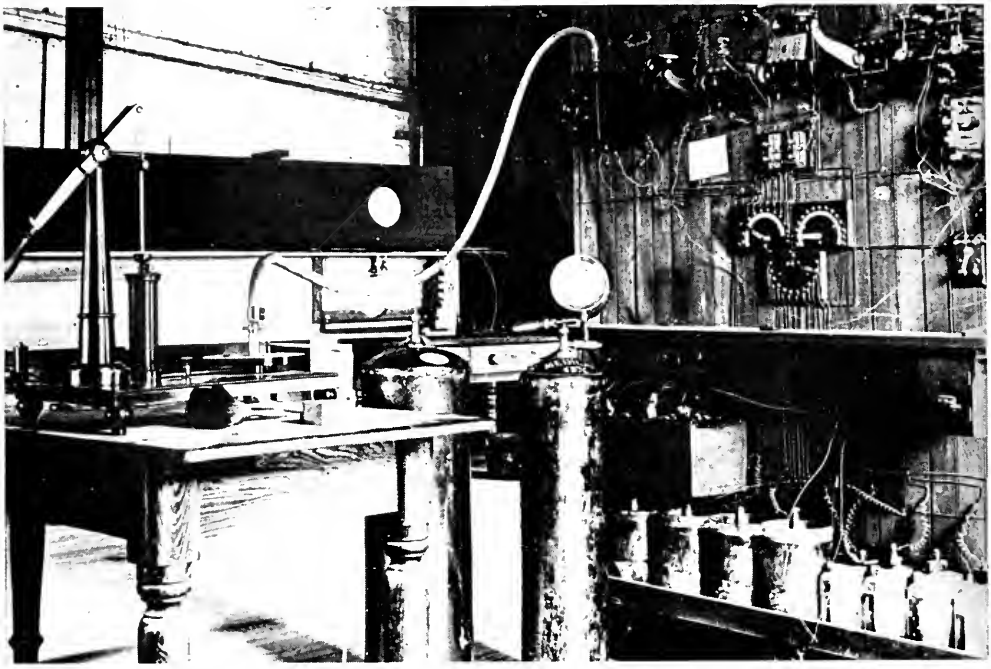
ANOTHER MILESTONE in the year 1904 was the development and commercial application of the first successful telephone repeater, invented by H. E. Shreeve, of Mr. Hayes's department.

The idea of inserting in a line one or more repeaters—or relays as they were called at first—to reinforce the weakened telephone current from a local source of energy was almost as old as the telephone itself. Many such devices had been invented, both within and without the Bell System, but none were satisfactory because of poor articulation, irregular operation, and singing.

The Shreeve repeater was of the mechanical type, in which the working parts of a telephone receiver and transmitter were combined in one instrument. By careful refinements in design, Shreeve was able to so reduce the inertia of the working parts that he succeeded where others had failed.

In August, 1904, the first commercial application of the Shreeve repeater was made at Pittsburgh on an open-wire circuit between Chicago and New York. Substantial improvements were made in this repeater in the years that followed, and it was used in the Bell System to a limited extent until superseded by the vacuum-tube repeater.

It was not until Arnold's improvement of the deForest audion, which led to the high-vacuum electronic tube in 1913, that a satisfactory vacuum-tube repeater became available. This was not due to a failure



A corner of the Mechanical Department laboratory at 127 Purchase Street about 1890

to recognize the possibilities of electronic amplification or to lack of efforts to achieve it by the members of Mr. Hayes's department. As early as 1896, stirred by the recent invention of the X-ray tube, John Stone Stone undertook studies and experiments of ways of utilizing the X-ray or similar tubes as a telephone relay. Similar studies were begun in 1904 of methods of using the mercury-vapor arc—invented by Peter Cooper Hewitt—as a telephone amplifier; and in 1906 and 1907, G. A. Campbell and T. C. Hebb studied the negative-resistance characteristics of the electric art with a similar objective in view.

Far-sighted Investigations

THIS WAS by no means the first instance where the far-sightedness of Mr. Hayes stimulated investigations that were so much in advance of their time that immediate practical results could not be obtained. In 1892, only a few years after the discovery of Hertzian waves and before Marconi's demonstration of wireless telegraphy, Mr. Hayes set John Stone Stone to work to see "if it might be possible to signal vessels at sea by means of electrical oscillations of high frequency transmitted to them through space without wires." In the Spring and Summer of 1892, Stone made a number of experiments in high-frequency transmission, both over wires and through space: the first attempts of the Bell System at carrier and radio telephony. Stone was partially successful in the wire side of this work; he failed in the radio side of it because of the lack at the time of a suitable high-fre-

quency generator and a radio detector.

It was also during these years that Mr. Hayes undertook studies of mechanical switching methods. The work began as early as 1888, but at first it was concerned chiefly with switching systems for the smaller offices, since to give 24-hour service with operators when only a comparatively few lines were involved inevitably meant excessive costs. By the beginning of the twentieth century, however, the situation was changed. The rapid growth of the telephone business in the large cities indicated that the greatest need for mechanical switching would be in the major centers, and by 1905 work was being actively prosecuted on a 10,000-line semi-mechanical switching system by Mr. Hayes's department in coöperation with the engineers of the Western Electric Company.

During the following years, work upon the design of mechanical switching equipment, of both the rotary and panel types, was prosecuted actively by the Western Electric Company, based upon the fundamental studies of requirements made by Mr. Hayes and his staff. Although several years elapsed before the semi-mechanical system was ready for commercial trial, and several more had passed before the final result—the full mechanical panel dial system—was installed in commercial service in the Bell System, a substantial amount of progress was made during the first few years on the design of the apparatus and circuits employed in this highly intricate power-drive system. Worthy of special mention in this early work are E. B. Craft, J. L. McQuarrie, A. F. Dixon, and F. R. McBerty, of the Western Electric Company; W. G. Blauvelt and E. C. Molina, of the A. T. & T. Company; and A. M. Bullard, who was employed at different times by both companies.

Among the many other projects carried on during this period was the development of methods of electrical protection. When the telephone came into commercial use, the only protective devices required were simple metal cut-outs to protect against lightning. These were inherited from telegraph practice. The growth of electric lighting systems, begun in the early 1880s, introduced new hazards: the danger of fire and other damage to the delicate telephone apparatus due to the possibility of accidental contact between the telephone wires and the high-voltage electric light wires. A new system of protection had to be devised. After a thorough analysis and considerable experimental work, Mr. Hayes's staff designed three protective devices: the carbon block lightning cut-out to guard the line in the presence of high voltage; the fuse to open the line in the presence of large currents; and the "heat coil" to protect the apparatus against comparatively small currents that were yet large enough if maintained over periods of time to damage the apparatus. In substantially unchanged form, these devices have continued in use to the present day.

Mr. Hayes's organization also undertook elaborate investigations into inductive coördination, into electrolysis effects and possible remedial measures, and into the development of

HEADQUARTERS TECHNICAL STAFF
AMERICAN BELL TELEPHONE COMPANY
DECEMBER 31, 1895
81 EMPLOYEES

ENGINEERS DEPT. JOSEPH P. DAVIS, CHIEF ENGINEER	MECHANICAL DEPT. H. V. HAYES. ELECTRICAL ENGINEER	EXPERIMENTAL DEPT.
CONDUIT PLANS AND DEVELOPMENT STUDIES: W. S. FORD J. A. HIGHLANDS B. W. TRAFFORD J. WYMAN TOLL TRAFFIC STUDIES: T. B. DOOLITTLE G. T. BLOOD T. COTTER A. J. DELANO J. A. McCABE R. A. NICHOLS BUILDINGS: L. F. RICE INSURANCE: C. J. H. WOODBURY INSPECTION: C. H. CUTLER DRAFTING: A. V. EDWARDS CLERICAL: S. H. MILDRAM M. J. HEANEY O. W. HOLLIS	TELEPHONE TRANSMISSION: W. L. RICHARDS J. S. STONE SWITCHBOARD ENGINEERING: L. S. GREENLEAF E. SLADE T. C. WALES, JR. W. R. WESCOTT A. S. WILLIAMS MECHANICAL CONSTRUCTION AND DESIGN: C. H. ARNOLD J. S. CODMAN A. deKHOTINSKY F. C. MOODY E. C. ROBES G. K. THOMPSON GENERAL ENGINEERING: F. L. RHODES CHEMICAL LABORATORY: J. C. LEE G.O. BASSETT WIRE INSPECTION: 3 INSPECTORS SHOP: 7 MACHINISTS DRAFTING: 7 DRAFTSMEN CLERICAL AND STUDENTS: 8 EMPLOYEES INSTRUMENT TESTING AND PACKING: 18 EMPLOYEES	W. W. JACQUES J. H. FLANNIGAN H. R. MASON

rules for the joint use of poles. Cooperation with other interests for the preparation of the National Electrical Code was also begun.

Many other developments of this period, such as the bridging station bell, four-party full-selective signaling, and machine ringing, although not originating in Mr. Hayes's department, were applied by it and improved under his direction. Although Mr. Hayes's work was primarily the direction of the studies and research of others, he never lost close contact with each project, and played an important role in many of the developments himself. His name appears as principal or associate on twenty-one United States patents issued between 1885 and 1907.

Developing an Organization

An important phase of Mr. Hayes's work was his development of the staff organization to meet broadly the engineering and operating requirements of the Associated Companies of the System.

He visualized that the companies would do the detailed engineering and operating work, with the Engineering Department confining itself, in addition to its fundamental engineering studies, to the preparation of standard specifications, data and methods for fundamental planning, bulletins on uniform operating practices, and maintenance instructions. It was to this end that he reorganized the department from time to time as specialization required; diverted functions properly belonging to other parts of the System, such as the inspection of construction material to the Western Electric Company; and separated technical and fundamental development work from the engineering side.

An example of this staff organization development is in the traffic department.

In 1899, Hayes pointed out the divergence of opinions among the operating companies as to permissible circuit and operator loads and other traffic matters, and the need for the Engineering Department to keep itself so informed as to be able to speak authoritatively on all points relating to operating practices. With this in view, he set up a separate department in traffic engineering; and while progress was made in succeeding years, he stated in 1905 that there was no field of development work requiring more earnest attention than the improvement in toll operating methods. He remarked on the waste of circuit time caused by operating irregularities, and the lack of speed, accuracy, and cost standards for measuring work in the different territories.

It was in 1905 that he put K. W. Waterson in charge of traffic engineering, who with Mr. Hayes's support pioneered in the development of the traffic unit system which provided a useful tool for calculating force requirements, and loads which could be carried while giving satisfactory service.

Service observing methods, simplification of toll and local operating methods, and systematized toll line

Opposite: Organization chart of the headquarters technical staff of the American Bell Telephone Company in 1895

and switchboard engineering practices also resulted from the importance which Mr. Hayes assigned to traffic matters.

As brought out in the Annual Reports to Stockholders of the late 1880s and early 1890s, the matter of rate reductions had been from the outset a problem requiring closest attention, not only from the point of view of placing telephone service within the reach of more and more persons, but also with the view of answering such general criticisms as those of the prevailing rate structures. It is not surprising, therefore, to find Hayes stressing the importance of operating economies; of developments in connection with metered service, party-line service, and machine ringing; and of reducing manufacturing costs of all items of equipment. As the result of such activities, the Annual Report for 1905 could mention that the marked reductions in rates over the past few years were due largely to the constant decrease in investment per station as a result of the introduction of sound engineering and construction methods and of the development of new classes of service, and to the year-by-year lowering of the average cost of operation per station.

Mr. Hayes's Later Years

Mr. Hayes withdrew from active service in the Bell System on July 1, 1907, just prior to the removal of the parent company's headquarters from Boston to New York, but he continued as consulting engineer of the parent company until 1913. During this period and for the following eleven years he also served as a consultant for many other firms, and published two books, "Public Utilities—Their Cost New and Depreciation," and "Public Utilities—Their Fair Present Value and Return."

He was a leader in developing and improving devices for detecting the presence of submarines, and of instruments for transmitting underwater signals, and served as a lieutenant in the Navy during the first World War. One of the firms for which he acted as consultant after 1907 was the Submarine Signal Corporation of Boston, of which he later became Chief Engineer, and from 1924 to 1930, President. During this latter period he was active in developing a navigation instrument for registering the depth of the ocean directly beneath a ship.

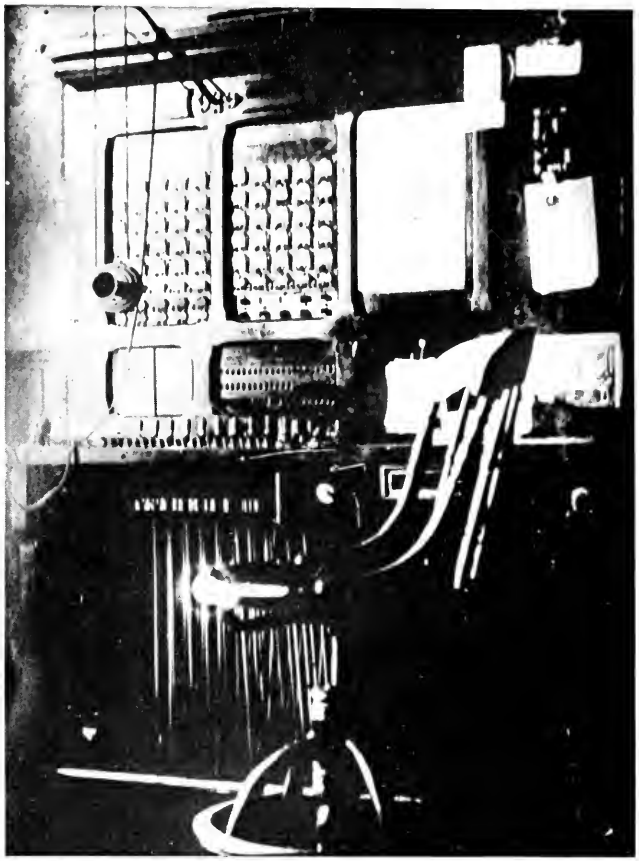
After his retirement from active work, in 1930, he investigated methods of signaling through fog by means of infra-red rays.

Mr. Hayes was a Fellow of the American Institute of Electrical Engineers, which he joined in 1889, and of the American Academy of Arts and Sciences, and a member of the Institute of Radio Engineers, the Acoustical Society of America, the Union Club of Boston, and the University Club of New York. During recent years he had maintained an office and laboratory at 253 Summer Street, Boston.

His residence at the time of his death—48 Beacon Street—is only a few minutes' walk from the site of the Williams machine shop at 109 Court Street, where the telephone was born, and from 101 Milk Street, 141 Pearl Street, 127 Purchase Street, 42 Farnsworth Street, and 19

Oliver Street where the Mechanical Department and its successor organizations carried on its work while Mr. Hayes was at its head.

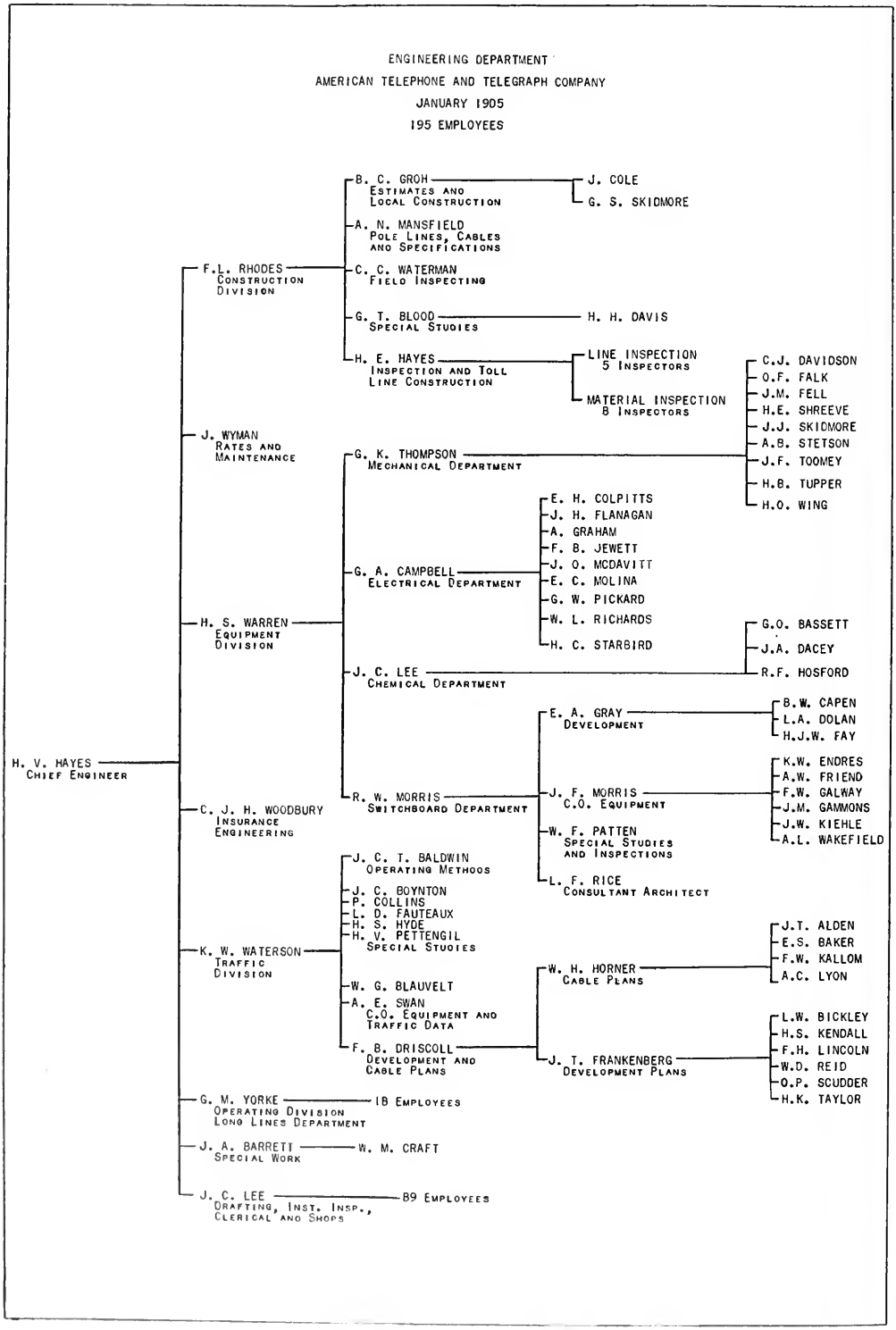
Although housed in humble quarters and with a comparatively small staff by present-day standards, the research and development organization directed by Mr. Hayes from 1885 to 1907 was, as has been indicated earlier, the forerunner of the present Bell Telephone Laboratories in both function and purpose.



The common battery switchboard installed at Lexington, Mass., in 1893—the first common battery switchboard used commercially

In a way, the telephone itself was a product of a development laboratory—but with a difference. Bell and Watson, struggling with the problems of the telephone in a small room in Williams' machine shop at 109 Court Street, Boston, were isolated workers seeking the solution of a single problem. To a large extent, both were practical inventors; they were not carrying on research, nor were they, in the usual sense of the word, developing. When Mr. Hayes took over the recently formed Mechanical Department, however, the telephone was already in practical use; what was badly needed was the development of circuits, apparatus, and systems that would improve the service and extend its scope. Research was also needed to disclose hidden relationships and laws on which future improvements might depend.

Mr. Hayes was eminently suited to carry on work of this type. One of his Boston associates, in close contact with him for a number of years, spoke of him thus: "A man of means and culture, representative of the best New England traditions, he was at once a scholarly scientist and an enthusiastic leader of his small band of technical workers." And he added that: "Distinguished for sincerity, honesty, and candor, he was singu-


ENGINEERING DEPARTMENT
AMERICAN TELEPHONE AND TELEGRAPH COMPANY
JANUARY 1905
195 EMPLOYEES
H. V. HAYES
CHIEF ENGINEER
F.L. RHODES
CONSTRUCTION DIVISION
B. C. GROH
ESTIMATES AND LOCAL CONSTRUCTION
J. COLE
G. S. SKIDMORE
A. N. MANSFIELD
POLE LINES, CABLES AND SPECIFICATIONS
C. C. WATERMAN
FIELD INSPECTING
G. T. BLOOD
SPECIAL STUDIES
H. H. DAVIS
H. E. HAYES
INSPECTION AND TOLL LINE CONSTRUCTION
LINE INSPECTION
5 INSPECTORS
MATERIAL INSPECTION
8 INSPECTORS
C.J. DAVIDSON
O.F. FALK
J.M. FELL
H.E. SHREEVE
J.J. SKIDMORE
A.B. STETSON
J.F. TOOMEY
H.B. TUPPER
H.O. WING
J. WYMAN
RATES AND MAINTENANCE
G. K. THOMPSON
MECHANICAL DEPARTMENT
H. S. WARREN
EQUIPMENT DIVISION
G. A. CAMPBELL
ELECTRICAL DEPARTMENT
E. H. COLPITTS
J. H. FLANAGAN
A. GRAHAM
F. B. JEWETT
J. O. MCDAVITT
E. C. MOLINA
G. W. PICKARD
W. L. RICHARDS
H. C. STARBIRD
J. C. LEE
CHEMICAL DEPARTMENT
G.O. BASSETT
J.A. DACEY
R.F. HOSFORD
R. W. MORRIS
SWITCHBOARD DEPARTMENT
E. A. GRAY
DEVELOPMENT
B.W. CAPEN
L.A. DOLAN
H.J.W. FAY
J. F. MORRIS
C.O. EQUIPMENT
K.W. ENDRES
A.W. FRIEND
F.W. GALWAY
J.M. GAMMONS
J.W. KIEHLE
A.L. WAKEFIELD
W. F. PATTEN
SPECIAL STUDIES AND INSPECTIONS
L. F. RICE
CONSULTANT ARCHITECT
C. J. H. WOODBURY
INSURANCE ENGINEERING
K. W. WATERSON
TRAFFIC DIVISION
J. C. T. BALDWIN
OPERATING METHODS
J. C. BOYNTON
P. COLLINS
L. D. FAUTEAUX
H. S. HYDE
H. V. PETTENGIL
SPECIAL STUDIES
W. G. BLAUVELT
A. E. SWAN
C.O. EQUIPMENT AND TRAFFIC DATA
F. B. DRISCOLL
DEVELOPMENT AND CABLE PLANS
W. H. HORNER
CABLE PLANS
J.T. ALDEN
E.S. BAKER
F.W. KALLOM
A.C. LYON
J. T. FRANKENBERG
DEVELOPMENT PLANS
L.W. BICKLEY
H.S. KENDALL
F.H. LINCOLN
W.D. REID
O.P. SCUDDER
H.K. TAYLOR
G. M. YORKE
OPERATING DIVISION LONG LINES DEPARTMENT
18 EMPLOYEES
J. A. BARRETT
SPECIAL WORK
W. M. CRAFT
J. C. LEE
DRAFTING, INST. INSP., CLERICAL AND SHOPS
89 EMPLOYEES

larly well qualified to direct the Bell System's early technical activities." He also spoke of the extraordinary skill and far-sightedness with which Mr. Hayes's task was carried on, handicapped as it was with very limited funds and personnel.

A letter addressed to him on his retirement and individually signed by 136 of the leading members of the Engineering Department says: "We, who have served as your assistants in the Engineering Department of the American Telephone and Telegraph Company, are moved to express the respect and esteem which every member of this Department has felt under the inspiration of your leadership. Through your high attainments as an engineer and the keen personal interest you have shown toward each of us individually, the Department has been lifted to its present high standard of efficiency and enthusiasm in its service to the Company. We feel that it has been our good fortune to have served under the standard which you have upheld, and we wish, with respect and sincere affection, to testify to the high ideals which you have constantly set before us."

No one man, of course, can solve all the problems of even so small an organization as was the Bell System at that time. One of the true evidences of the able direction of research and development is the ability to select suitable men to carry on various phases of the work and to stimulate them to the highest achievement by appreciation and encouragement. Evidence of Mr. Hayes's ability in this direction is the large number of men of his organization who have since made individual names for themselves in the telephone industry. A list of a few of those who are still active, or were until recent years, will suggest a much more extensive list to those familiar with the earlier days of telephone development. O. B. Blackwell, G. T. Blood, G. A. Campbell, H. P. Charlesworth, F. J. Chesterman, E. H. Colpitts, H. E. Darling, R. S. Hoyt, F. B. Jewett, E. C. Molina, R. W. Morris, F. L. Rhodes, W. L. Richards, H. E. Shreeve, G. K. Thompson, J. F. Toomey, H. S. Warren, and K. W. Waterson are all names of outstanding significance in the telephone industry, and they all served under Mr. Hayes.

Opposite: Organization chart of the Engineering Department of the American Telephone and Telegraph Company in 1905

Twenty-five Years Ago in the BELL TELEPHONE QUARTERLY

Items from Volume I, Number 3, October 1922

Death of Dr. Bell

AMONG the most impressive of the tributes to the memory of Alexander Graham Bell, who died on August 2, was that of the telephone system which bears his name.

As the body of the inventor was being laid at rest on the summit of Beinn Bhreagh, near his summer home at Baddeck, Nova Scotia, on August 4, service was suspended for one minute on all lines of the American Telephone and Telegraph Company and its associated companies, both in the United States and Canada.

Memorial resolutions were passed by the Directors of the American Telephone and Telegraph Company at a meeting held on August 15. Quite fittingly, this tribute is recorded as coming not merely from the Bell System as an organization, but on behalf of the hundreds of thousands of telephone workers of the world.

The resolutions follow:

"In the death of Alexander Graham Bell the civilized world mourns for a man who thought fearlessly, worked tirelessly and served generously to relieve the unfortunate and to benefit humanity.

"He was the inventor of the telephone because his thoughts adventured into new and untried fields of science, because his enthusiasm for discovery was sufficient to overcome all difficulties, because his practical mind demanded a consummation of his theories in practical results, and because he was inspired to contribute greatly to the common good.

"As an investigator he was intelligent beyond the genius of his age. In the invention of the telephone he founded the art of transmitting speech electrically, a new and invaluable contribution to the humanizing of mankind.

"He was one of the few in history who lived to see the child of his brain developed into a world-wide service. This was the only reward he sought and this reward was fully his.

"Whereas, this company was founded upon and is devoted to the development of his invention for the service of humanity, it seems proper that we, the directors of the American Telephone and Telegraph Company, for ourselves and in behalf of the men and women of the Bell System should spread upon our records our recognition of the debt owed to Alexander Graham Bell by the hundreds of thousands of telephone workers of the world for the opportunity for service which his invention made possible."

From "Notes on Recent Occurrences."

Dr. Bell's Telephone Service

DEAR MR. CARTY:

I am beginning to get distressed over the many statements the papers have been publishing of Mr. Bell's dislike of the telephone.

Of course, he never had one in his study. That was where he went when he wanted to be alone with his thoughts and his work. The telephone, of course, means intrusion by the outside world.

And the little difficulties and delays often attending the establishment of conversation in even well managed telephone circuits did irritate him, so that as a rule he preferred having others send and receive messages. But all really important business over the telephone he transacted himself.

There are few private houses more com-

pletely equipped with telephones than ours at 1331 Connecticut Avenue, and there was nothing that Mr. Bell was more particular about than our telephone service here. [Beinn Bhreagh, N.S.]. For nearly all of the thirty-five odd years we have been here he saw personally to its proper working. We never could have come here in the first place or continued here, but for the telephone which kept us in close touch with doctors and neighbors and the regular telegraph office. . . .

Mr. Bell did like to say in fun, "Why did I ever invent the Telephone," but no one had a higher appreciation of its indispensableness or used it more freely when need was—either personally or by deputy—and he was really tremendously proud of it and all it was accomplishing. He appreciated the honor of being first to talk from New York to San Fancisco, was awed by the wonder of its performance at that dinner at the New Willard, followed with interest its usefulness during the war, and the development shown at Arlington last autumn.

Mr. Bell's one regret about the telephone was that his wife could not use it or follow his early work in sound.

I honestly believe this had much to do with his not going on with the photophone experiments and engaging instead in aerial work the progress of which I could see as well as he.

I shall always be so thankful that the telephone worked so well that last day—serving its father so loyally.

Yours very sincerely,

MABEL G. BELL

August 24, 1922.

From "Notes on Recent Occurrences."

Experimental Broadcasting Service

ON OCTOBER 2ND the original license was superseded by one granting permission to broadcast on 400 meters. As a result, a new time schedule has gone into effect assigning the afternoon hour from 4:30 to 5:30 every week-day and the evenings from 8 to 10 on Monday, Wednesday, Thursday and Saturday.

Beginning July 25th when the first license was issued, steps were taken to interest prospective users of these broadcasting facilities. The results obtained up to October 2nd were very encouraging but it was apparent that a license to operate only one night a week constituted a very real handicap to the building up of business. The new time schedule with permission to use a wave length of 400 meters has materially improved this situation. With a desirable hour every afternoon and four evenings a week every effort will be made to popularize this new radio service, and it is expected that in the near future evidence will be at hand indicating how extensively it will be used by the public.

From "Notes on Recent Occurrences."

World's Telephone Statistics

ON JANUARY 1, 1921, there were 20,850,550 telephones in the world; of these 13,329,379, or 64%, were in the United States and 12,601,935, or 60% were connected to the Bell System. The number of telephones in all the countries of Europe combined was 5,289,606, or 25% of the world's total; all other countries had 2,231,565 telephones, or only 11% of the world's total. During the seven years 1914 to 1920, inclusive, 5,962,000 telephones were added to the telephone systems of the world, an increase of 40%. The total number of telephones at the beginning of 1921 was equivalent to 1.2 instruments for each 100 of the world's population.

From an article by S. L. Andrew, former A. T. & T. Chief Statistician.

(Continued from page 111)

in February of this year. His uniform bears many decorations awarded him by three countries. He contributed "A War Game Test of Telephone Service" to the QUARTERLY for January 1939.

As THE ravages of the recent war are repaired, communications are increasingly restored—and facts about them become more readily available. Thus, JAMES R. McGOWAN's discussion of telephone statistics in this issue is considerably fuller and more complete than his "Telephones in the Post-War World," in the MAGAZINE

James R. McGowan

for Autumn 1946 could be. His ten years of A. T. & T. service with the Chief Statistician's Division, devoted to studying and reporting on the statistics and economics of foreign telephone development, were interrupted by more than four years of military duty, spent in statistical and administrative work with the Signal Corps in Washington and with the Economics Division of Military Government in Berlin.

TURNING BACK the pages of history half a century, ROGER B. HILL and THOMAS SHAW appraise and acclaim the contributions to the development of the Bell System made by one man: Hammond V. Hayes.

Mr. Hill entered the Engineering Department of the American Telephone and Telegraph Company in 1911, and for several years thereafter was engaged principally in appraisal and depreciation studies. When the Department of Development and Research was formed in 1919, he transferred to it, and since then has been largely concerned with studies of the economic phases of development and operation. He has been a member of the staff of the Bell Telephone Laboratories since 1934, first in the Outside Plant Development Department and later in the Staff Department. In addition to his work on the economic side of the telephone business, Mr. Hill has taken great interest in the early history of the telephone art, and has assisted with the preparation of several books and articles dealing with that subject.

Memories of the inspiring personality and leadership of Hammond V. Hayes contribute greatly to the satisfaction Mr. Shaw derives in writing of some of the work carried on under Mr. Hayes's direction. Joining Mr. Hayes' department after graduation from M. I. T. in 1905, Mr. Shaw was included in the transfer of the Engineering Department from Boston to New York, following the general reorganization in 1907. For more than a decade thereafter, he engaged in the development of transmission apparatus, including loading coils. He became a charter member of the Department of Development and Research when it was organized in 1919, and joined the Bell Telephone Laboratories in the 1933 amalgamation. As loading engineer, he has since been concerned chiefly with problems of telephone-circuit loading, including the transmission and economic aspects of the loading apparatus.

Number Four Winter 1947-4

Bell Telephone MAGAZINE

Operator Toll Dialing — The Coming Way
RALPH I. MABBS

The International Telecommunication Conference of 1947 • BARTLETT T. MILLER

"Arms of the Law" — Police Communications
RICHARD B. HOLT

Weather Charts by Wire for the Air Force
HARRY JEAVONS

The Biggest Offer Ever • FREDERICK A. WISEMAN

merican Telephone & Telegraph Company · New York

Bell Telephone *Magazine*

Winter 1947-48

Operator Toll Dialing—the Coming Way, *Ralph I. Mabbs,* 181

Keeping Our Sights High, *Keith S. McHugh,* 191

The International Telecommunication Conference of 1947, *Bartlett T. Miller,* 192

Opening of New York-Boston Radio Relay System Is Historic Event, 204

"Arms of the Law"—Police Communication, *Richard B. Holt,* 208

Forest Fire: What an Unchecked Holocaust Wrought in Maine, *Timothy P. Mannix,* 221

Weather Charts by Wire for the Air Force, *Harry Jeavons,* 228

Twenty-five Years Ago in the Bell Telephone Quarterly, 240

The Biggest Offer Ever, *Frederick A. Wiseman,* 242

A Medium of Suggestion & a Record of Progress

Published for the supervisory forces of the Bell System by the Information Department of AMERICAN TELEPHONE AND TELEGRAPH CO., *195 Broadway, New York 7, N. Y.*
WALTER S. GIFFORD, *Pres.;* CARROLL O. BICKELHAUPT, *Sec.;* DONALD R. BELCHER, *Treas.*

Who's Who & What's What *in This Issue*

FROM 1916 to 1922 RALPH I. MABBS held traffic posts with the Long Lines Department in cities of the southwest before he transferred to the O. & E. Department of the A. T. & T. Company. There he adapted the principles of trunking to the "coefficient" method of measuring operator work volumes which is now in use throughout the Bell System. In 1926 he entered traffic field work again, with the New York Telephone Company. Returning to the O. & E. Department in 1929, he has since been engineer, toll traffic engineer, traffic methods engineer, and, currently, traffic facilities engineer. To the Winter 1944–45 issue of this MAGAZINE he contributed his lucid explanation of "Providing Paths for Long Distance Calls."

A STATEMENT of the Bell System career of KEITH S. MCHUGH, A. T. & T. vice president in charge of Public Relations, was given in the Autumn issue, in which was published his inquiry into "How Big Are the Little Things in the Telephone Business?"

WHILE he was in general charge of the Bell System group attending the International Telecommunication Conference, and, indeed, while he was preparing this issue's description of what went on there, BARTLETT T. MILLER was an assistant vice president in the O. & E. Department of the A. T. & T. Company. Since January 1, 1948, he has been A. T. & T. vice president in charge of the Long Lines Department. His telephone career began in 1910, when he joined the Colorado Telephone Company. Traffic and Commercial work in the west and with the New England Telephone and Telegraph Company preceded his successive appointments with the latter company as vice president, Public Relations; vice president, Public Relations and Personnel; and vice president and general manager—the job he relinquished in 1946 to go to 195 Broadway.

JOINING THE Long Lines Department in New York in 1936, RICHARD B. HOLT had both Plant and Commercial experience before he was transferred to Washington,

Ralph I. Mabbs

Keith S. McHugh

Bartlett T. Miller

Richard B. Holt

Timothy P. Mannix

Harry Jeavons

D. C. Here, during the war, he was engaged in servicing work for the Army's nation-wide communication networks—and received the Army's Certificate of Appreciation for it in 1946. In that year he transferred to the O. & E. Department's commercial division, where he has since been busy, in the sales and servicing section, with toll and private-line servicing activities.

WITH A BACKGROUND of newspaper work which included special feature, editorial, and political writing, TIMOTHY P. MANNIX joined the staff of *Telephone Topics*, the employee magazine of the New England Telephone and Telegraph Company, in Boston in 1942. He subsequently became its editor, and is now information supervisor of the company.

WITH THE Long Lines Department since 1913, HARRY JEAVONS was press service manager from 1929 to 1940. In the latter year he was made division commercial manager at Washington, D. C., and there he rendered service during the war to military and civilian agencies, in connection not only with their private-line service requirements but with their domestic and international communication networks. His Army Certificate of Appreciation was "for outstanding service through the establishment and maintenance of the national teletypewriter and telephone networks of the Signal Corps in record time." In 1945 Mr. Jeavons served as president of Alexander Graham Bell Chapter of the Telephone Pioneers of America. The illustrations which accompany his article are by courtesy of the U. S. Weather Bureau.

THE OPERATION which FREDERICK A. WISEMAN describes so vividly, he knows more than a little about. He has to: he was Security Issue manager. He has been since 1930 an A. T. & T. assistant treasurer, and since 1942 head of the financial di-

(Continued on page 252)

Frederick A. Wiseman

Installation of crossbar toll switching equipment in the Long Lines Department's headquarters building in New York—another step in the Bell System's operator toll dialing program. *See the article beginning on the opposite page*

A Program Is in Progress throughout the Industry Which Will Increase the Speed and Accuracy with Which Toll Calls Go Through to the Called Telephone

Nation-wide Operator Toll Dialing—the Coming Way

Ralph I. Mabbs

This is the text—with minor editorial revisions—of a talk which was given in Chicago on October 14, 1947, in connection with the Fiftieth Anniversary Meeting of the United States Independent Telephone Association—EDITOR.*

OPERATOR TOLL DIALING is a very promising development for toll telephone service.

Equipment that will do the job costs about the same as other types of dial equipment. Although not available in quantity now, it takes about the same time to manufacture and install. And once it is in, its effect on service is immediately noticeable. Those of you who have seen it are no doubt well aware of its greater speed in handling direct-circuit calls. You may have noticed, too, that switched calls may be put through almost as quickly as direct-circuit calls.

There were, of course, many engineering problems involved in the introduction of operator toll dialing. But most of them have been solved. The program is progressing satisfactorily on an industry-wide basis, and right now more than five percent of the country's traffic between toll centers is handled by this method. Once the material scarcities are overcome and enough time has elapsed to permit more of this equipment to be installed, telephone customers are going to be greatly pleased with the speed and accuracy with which their calls are handled.

Before discussing the operator toll dialing plan as it is now foreseen, I should like to take a moment or so here to review the steps in the present and familiar manual method of handling toll calls—the so-called ring-down method. I think it might help

* See also "A Dial Switching System for Toll Calls," MAGAZINE Winter 1943–44; "Operator Toll Dialing—A New Long Distance Method," MAGAZINE Summer 1945.

provide a good platform on which to make comparisons with the dialing method, and at the same time point up some of the objectives for toll dialing.

Steps in Handling Ring-down Toll Calls

LET US TAKE, first, the direct circuit call.

After the calling operator gets the call details, she asks the calling party to hold the line. She then determines the route to the called place. Usually, 85 or 95 percent of the time, she gets that information from the bulletin right in front of her. On the rest, she obtains the route from the route desk. The customer in either case is holding the line.

Here are the rest of the steps. She selects a circuit and rings. Then when the inward operator in the called office answers, the calling operator passes the called telephone number, or the name and address. And as you know, if the called telephone number is not known by the calling operator, and the inward operator cannot supply the number from memory or from a bulletin at her position, inward connects her to an information operator.

Now the inward operator secures the called line on a switching trunk, rings the called station, and reports to the calling operator if the called line is busy or does not answer. In the meantime, while the inward operator is ringing the called number, the outward operator is requesting the calling number and completing the ticket details.

If the called station answers and it is a station-to-station call, the operator starts timing the conversation, cuts herself out of the connection, and proceeds with other work. If it is a person-to-person call, of course, she first reaches the desired party. When the call is ended, the calling operator receives a signal by means of a switchboard lamp associated with the cord of that connection. She then stamps or times her ticket, releases the connection, and sends the ticket to the filing position.

That's the direct circuit call.

If the call is to a built-up point, the originating operator asks the operator at an intermediate office for a circuit to the called office. This operator then selects a circuit and rings the called office. And in those cases where there is more than one intermediate office, the calling operator reaches each of the intermediate offices in turn and obtains a circuit to the next point.

If a no-circuit condition exists at the originating office, the operator holds the calling party on the line for one minute while she attempts to obtain a free circuit on any authorized route. At the end of that minute, if no circuit can be obtained, the customer is given a report and released. The operator holds his line for ten minutes, and during that interval she makes further attempts to secure a circuit. If she cannot obtain a circuit within the ten minutes, she releases the calling line and sends the ticket to a delayed-call position, where further circuit attempts are made.

There is one more condition I'd like to mention: no circuit at an intermediate office. Circuits to intermediate offices are usually held for five minutes while the intermediate

operator attempts to secure one. If she cannot, she records a call order and the calling circuit is released. The intermediate operator continues in her attempts to secure a circuit to the called office and, when she does so, she connects the calling office with the next office.

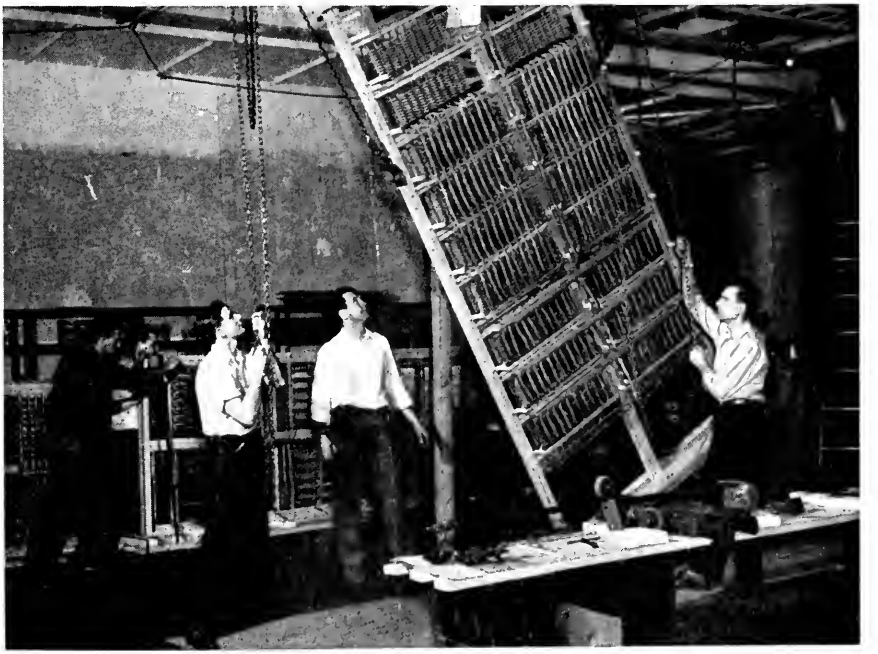
Ring-down Routing Plan

BEFORE we get into operator toll dialing, there is one other phase of ring-down operation I should like to point up: the routing of calls. To facilitate routing arrangements, toll centers are grouped into two classifications. Those designated as Class One are strategically located on main circuit routes. There are about 350 of these. The rest are grouped around these Class One offices, and are called Class Two.

In every Class One office, there is a simple route sheet which shows the route to every other Class One office, and many of these are direct routes between Class One toll centers. If you wanted to know the route to a most remote locality, all you'd have to know is the toll center and the Class One office through which it is reached. Both of these you could find in the Rate and Route Guide for every point.

Actually, in the day-to-day job you would need to refer to the Guide only rarely—on generally less than five percent of the calls. Routing bulletins, provided at each position, show all direct circuit points and as many of the others as can be usefully included. In addition there is a quick reference file at the Route Desk which lists additional places.

Percentage-wise, here is the way it breaks down:—



Erecting a crossbar frame in the Long Lines building in New York

The routing of 82 percent of long distance calls is direct. Frequently an alternative route is provided through an intermediate office.

Calls which go through one intermediate office are about 16 percent of the total, and there is often an alternative route through a different intermediate office.

The rest of the calls, less than two percent, require two or more switches. These usually involve far distant or very small places between which there is infrequent calling.

Circuit engineers and control bureaus constantly study the flow of traffic, and in order to maintain a balanced load on available circuit groups, routing arrangements undergo frequent change. Circuits are shifted from group to group. New direct circuit groups are created. And traffic is routed to other groups. To meet changes in traffic distribution between day and evening periods, for holidays, and as a result of out-of-order conditions, circuits are frequently shifted on short notice.

There are three ways in particular that operator toll dialing smooths the way for faster completion of calls:

1). Improvement in the speed with which the operator obtains the routing on a call;

2), Lamp signal supervision of the called station (i.e., visual indication that the called telephone has answered); and,

3), The elimination of delays at the intermediate toll centers on switched calls.

The first one, improvement in the speed with which routings are obtained, is brought about by the nation-wide numbering plan.

Nation-wide Numbering Plan

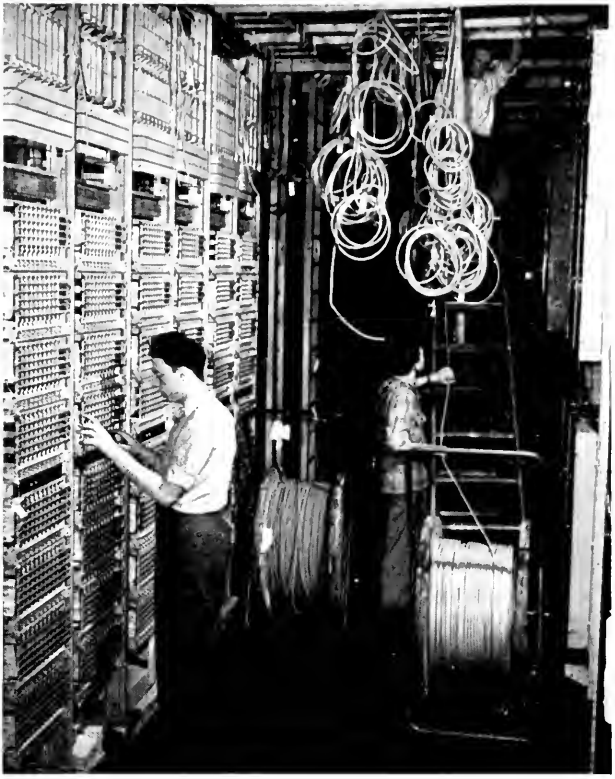
UNDER operator toll dialing, it is proposed not to increase the number of digits that a customer must dial on a local call merely because of the introduction of toll dialing.

Under this plan, an operator will dial seven digits to reach a number in her own state or numbering-plan area, or ten digits to reach a number in another state or numbering-plan area. An individual designation, called a routing code, must therefore be created, by the selection of a three-digit number, for each central office, for both Bell System and independent companies, in the United States and other adjacent countries included in the operator dialing plans. It is this three-digit code which a calling operator will dial in order to reach a given central office.

Local numbers vary by places from three digits in the smaller towns to seven digits in the larger cities. In many cases, some numbers are four digits and others are five in the same place, and in other places there are five- and six-digit numbers. In some mixed five- and six-digit places, the numbers consist of all numerical digits, while in others they consist of one letter and four or five numerals. Mixed six- and seven-digit places may have two letters and four or five numerals in the number. Seven-digit cities may have three letters and four digits in the local number or two letters and five digits.

All of these arrangements are appropriate for the places in which they exist, but I believe it is clear that a long distance operator in a distant city might well be uncertain what to dial in many cases unless rules are given for her guidance.

Perhaps you can see from this description of the present numbering arrangements that there is a problem of choosing central-office routing codes for operator toll dialing which must be superimposed on the present numbering arrangements.



Installation progresses: frames of crossbar equipment at the left

That problem will be met in this way: The United States and Canada will be divided into 82 numbering-plan areas and, where practical, these areas will include an entire state or province. Each area will include up to approximately 500 central offices, and each office will be assigned a three-digit routing code which does not conflict with any other routing code in its area. Each numbering-plan area will *itself* be reached by means of a three-digit code that does not conflict with any other area code or with any central-office routing code (see page 188).

Thus, each central office in this country and in Canada will be designated by six digits which will distinguish it from every other central office in the two countries. A maximum of ten digits dialed by the originating operator will reach any telephone: three digits for the area code, three digits for the central-office code, and four digits for the called line number. The few exceptions to this ten-digit standard include principally the party-line designations and three-digit central office numbers. To change these would, of course, result in considerable expense and annoyance to telephone customers.

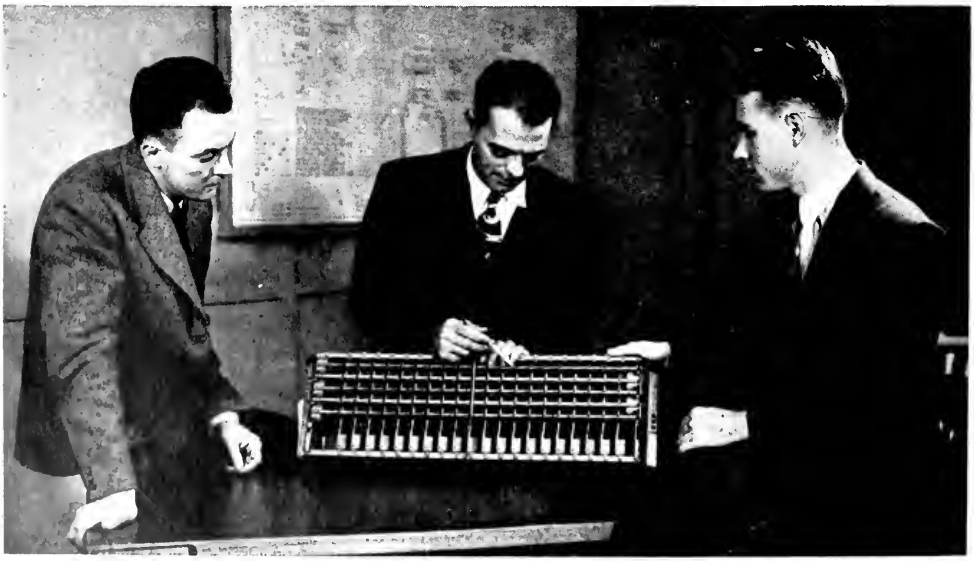
Now let us look at the make-up of the codes themselves. In the Bell System, and in many of the independent telephone companies, "0" (zero) is reserved as a special code by which a customer reaches the operator. "Zero" therefore is not available as the first digit of a routing code. The figure "1" (one) is avoided as a first digit of a code because our equipment is arranged so that an initial pulse of "1" is ineffective. These figures, "0" and "1," are not used in central-office names and there are no letters

on the dials in the "0" and "1" positions. (You may have noticed that in some places the dial number plate has the letter "Z" in the "0" position, but it is not used as part of a central-office name.)

Just because we cannot use them to start a central-office code, however, does not mean we cannot use them in the numbering-plan area codes. With "0" and "1" in the area code, this code is distinguished from all central-office routing codes. Area codes with a "0" in the middle will be assigned to numbering-plan areas which include all of a state. Codes with "1" in the middle will be assigned to numbering plan areas in states which have more than one numbering-plan area.

In the central office, the operator will have a bulletin at her position which shows the numbering-plan area codes for all of the single-area states and for the larger cities in each numbering-plan area of the multi-area states. If she is handling a call to a distant city in a state in which the area code has a "0" in the middle, and the number given by the customer has more than four digits, she will know that she may proceed with the call without reference to the routing operator, since the "0" in the code indicates that it gives access to the entire state.

When she receives a call for a city listed on her bulletin and the area code for that call has a "1" in the middle, she knows that she may proceed with that call but may not go ahead with any other call to points in that state not listed in her bulletin without reference to the routing operator. On calls for which neither the state nor the city is listed on the bulletin, she must of course refer to the routing operator.



Students examining a crossbar switch. The installation of toll dialing equipment in New York has brought about the largest single plant training project in Long Lines's history

Since each call which must be referred to the routing operator is delayed by the additional seconds that must be added to the time required to establish the connection, any plan that can be followed in the assignment of routing codes that makes it unnecessary to refer to the routing operator will improve the quality of the service.

As mentioned earlier, numbering-plan area boundaries will, in general, coincide with state boundaries. In each of the fourteen states which have more than five hundred central offices, including independent company offices, there will be anywhere from two to five numbering-plan areas. In determining the locations of boundaries between numbering-plan areas, a few general rules were followed. All tributaries of a toll center are included in the same area as the toll center. And as much as possible, boundaries within a state are located so as to avoid cutting across heavy toll routes.

Assigning Routing Codes to Central Offices

At this point, I should like to speak of the plan followed in assigning routing codes to the central offices within a numbering-plan area.

Please bear in mind, now, that the objective is to establish central-office routing codes that will minimize the number of calls on which the operator must refer to a bulletin or to the routing operator to obtain the route. Also, it would be most advantageous, if possible, to assign all central-office routing codes so that the operator could tell the routing code from the number given by the customer—since the customer gives the number on about 80 percent of the calls placed.

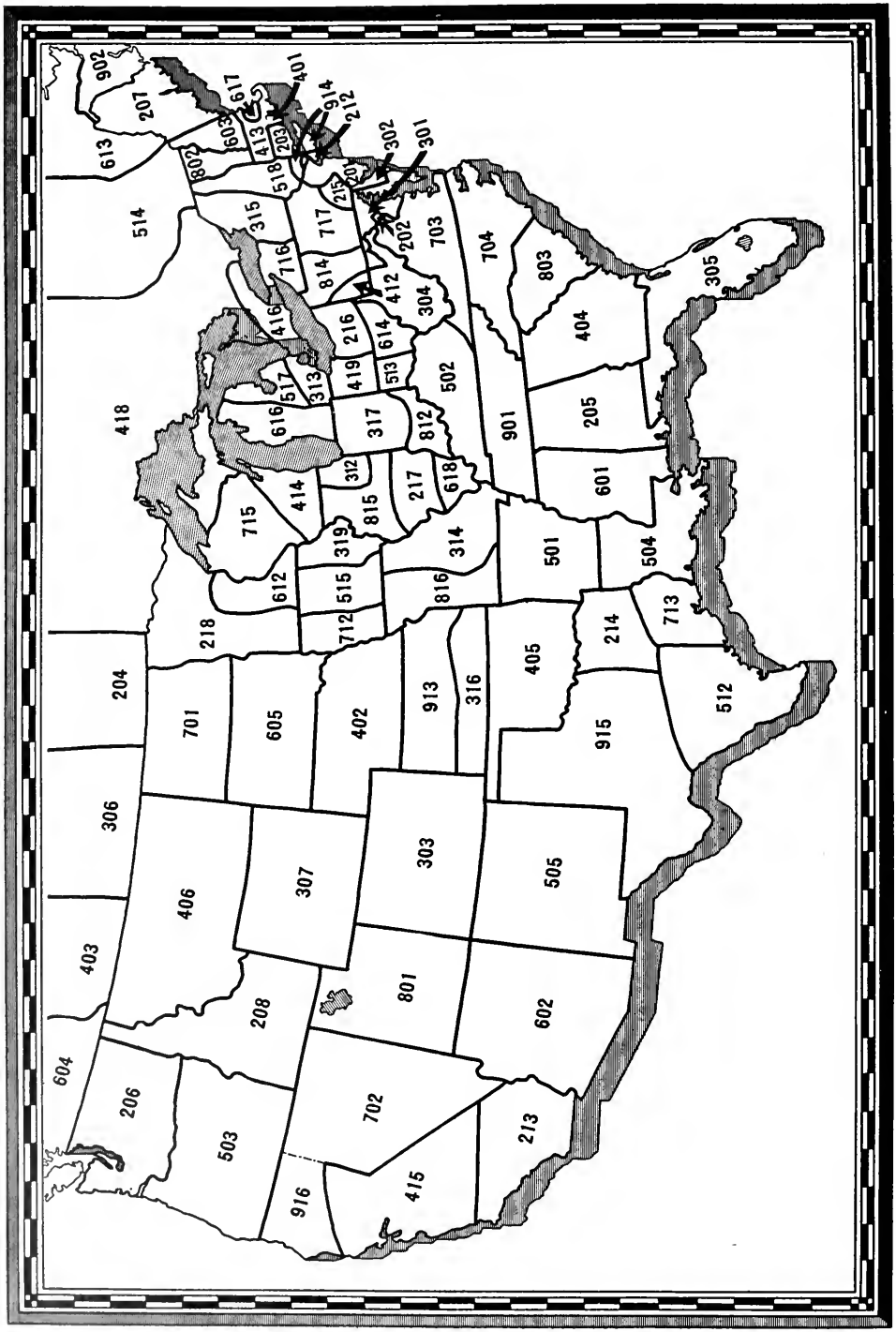
In the seven-digit cities, all central offices have names. In some cities, the first two letters of the office name and a numeral form the office designation—CO(ortlandt)7–1234 in New York City, for example. In others, the first three letters of the office name form the designation—as in Chicago's CEN(tral)–5678. Central-office routing codes are made to conform with the central-office designations in these cities.

In six-digit cities, which have office names, the code is made to correspond with the first three letters of the office name—HOP–1234 to reach HO(pkins)–1234 in Providence, R. I., for instance.

In cities with five-digit numbers (these central offices do not have names) the first two letters of the city name and the first digit of the telephone number are used as the central-office routing code. In Albany, N. Y., by way of example, this would be (AL)3–4567.

Cities with four or less digits will be given three-digit numerical codes which will be based on the first two letters of the city name, as far as this is possible without introducing code conflicts within an area. For Salem, Ore., the central-office routing code would be 725, corresponding to SAL. In some states there are many cities whose names begin with a word such as "San," "Saint" or "New." This makes it impossible to follow the city name rule in many cases.

You will note that, by applying these rules, the operator can tell on a high percentage of calls what the central-office routing code is from the number in the distant city given by



Numbering-plan areas and their codes in the United States and Canada

the customer, and can proceed at once with the handling of the call without reference to bulletin or to the routing operator.

Steps in Handling a Dialed Toll Call

NOW LET ME FOLLOW the steps in the handling of a call under the proposed numbering arrangement.

The customer reaches long distance in the usual manner, and the operator records his call just as she does today. If he gives a seven-digit called number and the call is to a city within her own numbering-plan area, the operator selects a trunk connected with the switching equipment and dials the number, using two or three letters of the office name as required to make seven digits. If the number he gives has less than seven digits, the operator makes up seven digits in one of the ways described in the preceding section.

When the call is to a city in another numbering-plan area, the operator obtains the area code from her position bulletin or, if necessary, from the routing operator, and dials this code plus the seven-digit number.* If the customer does not give the called number, she obtains it from the information operator at the called place and proceeds as described before.

On station-to-station paid calls, she does not remain connected to the circuit after dialing the number, but times the conversation from signals which indicate when the called station has answered. On person-to-person calls, she remains in on the connection to supervise the start of conversation. When the signals indicate that both calling and called stations have hung up, she takes down the connection.

The proposed numbering arrangement must, of course, make provision for the operator to reach other operators at distant toll centers. She may want to reach an information operator to obtain the telephone number on a call placed by name and address, or she may want to ask an assistance operator at a distant point for help in completing a call or in

NUMBERING-PLAN REQUIREMENTS

* * *

A distinctive telephone number for each telephone in the United States and Canada

*

The minimum number of digits which will provide for

Growth

New services

*

Minimum changes in customers' numbers

Minimum changes in local dialing practice

Least cost for equipment changes

*

Minimum reference to Bulletins and Route Guide

To gain speed-of-service advantage

*A very high percentage of the calls are handled over direct circuits between the calling and called places. In a majority of the toll centers, these direct circuits appear in the multiple before the operator. Because of this, the operator in many cases need not dial the area code to reach the distant office, even though it is in a different numbering-plan area. She merely plugs into the direct circuit and dials the called number.

verifying a busy or don't answer condition. Also, the operator may need to reach a delayed-call operator when a customer reports he is ready to talk on a call which reached his telephone while he was not available.

Each toll center will have assigned to it a three-digit toll office code similar to the local office codes already described. These codes will not conflict with any other toll or local office codes in the numbering-plan area. When the operator wishes to reach an operator at the distant toll office, the toll office code will be used.

Methods of Eliminating Code Conflicts

SINCE the numbering-plan arrangements are necessary to successful operation of the plan, the first step in preparation for its introduction is to assign non-conflicting routing codes to each central office.

In the transition from the present to the proposed numbering, there will be some code conflicts. Such conflicts, however, will be eliminated in some cases by changing central office names, and in others, by using numerical codes not related to the town name.

An example of this is the State of Washington numbering-plan area, where there are three cities which have a central office designated as MAIN. Two of these must be changed. In a few of the smaller cities without central-office names, equipment changes will sometimes need to be made to eliminate conflicts between towns whose names start with the same two letters.

IN CONCLUSION, I should like to note that under the operator toll dialing plan there are numerous equipment and inter-toll trunk layout arrangements which have important functions in achieving the general service improvements.

To mention a few—

All of the important switching points will be equipped with facilities which will complete intermediate switches in a second or two.

Automatic alternative routing will be provided at the switching centers. Calls encountering all circuits busy over the first route will automatically and immediately be offered to other routes, so that in the end only a very few of them will be delayed because there is no idle circuit.

Terminating equipment will select and ring the called number, and through supervisory signals will then indicate to the originating operator when the called station answers or whether it is busy.

I said earlier that operator toll dialing makes for improvement in three ways in the speed with which long distance calls are handled. The numbering arrangements improve the speed with which an operator obtains the routing of a call; the switching facilities at intermediate offices, and the automatic alternative routing, speed the connection at intermediate offices; and the through supervisory signals enable the operator to determine the status of a call at a glance rather than having to wait for a report of its status from the terminating operator.

It is these features which make operator toll dialing "the coming way."

Keeping Our Sights High

Keith S. McHugh

The following paragraphs are from an address, "The All-American Telephone Team," given before the Fiftieth Anniversary Convention of the United States Independent Telephone Association in Chicago on October 15, 1947.—EDITOR.

I BELIEVE that all of us on the telephone job in the next few years are going to have our hands full. The everyday pressure of work will see to that. But we shall want to keep the long view too, and this anniversary is the best kind of occasion for looking well ahead.

Today, as we celebrate the first half century of service of this Association, there are any number of young men and women 20 years old, more or less, who are just starting out in the telephone business. Year by year, the next half-century of progress will be increasingly theirs; and as they grow into the business, and grow with it, and as the new leaders among them prepare to take the helm, they will want to have from us all the help that we can give.

The best way for us to assure them that help, it seems to me, is to keep our own sights high and keep on raising them as we go along. If we do that, and I am sure we will, we can have complete confidence in the job that the young people of today will do when they are called upon to lead the way tomorrow.

NO ONE CAN now foretell the precise extent and character of telephone service 50 years from now. But there are a few general characteristics that most of us cannot help seeing in our mind's eye. We expect to devise better facilities and to make better and more efficient use of them. We see the means of instant communication made ready at hand everywhere, on land, at sea and in the air, in more convenient and more varied forms. We look forward to a service which in speed, in flexibility and in world-wide usage will infinitely surpass anything that we have ever known.

Unless continuous calamity overtakes the world I see no reason to doubt these prospects, provided only that the will to accomplish them energizes everything we do. And here in this country, our All-American telephone team has greater opportunities than are generally to be found elsewhere.

THE PRIVATELY OWNED telephone companies of America have always led all the rest of the world in bringing fast, dependable telephone service to offices, homes, and farms. In doing this a great industry has developed giving useful and interesting employment to hundreds of thousands of people. All this has been possible because the job has been done with American zest and enterprise, and because those charged by the public with the regulation of these companies have had the wisdom over the years to permit them to earn enough to secure the capital needed to expand and improve their services.

The social and political events ahead are hidden from us. But we may take heart and hope in the future when we look at the record of the past. With good will between us, whatever new troubles lie ahead—and we may be sure there will be many—can be met and surmounted, to the end that the people of this nation will continue to have an increasingly finer telephone service and always the finest in the world.

Three Conferences in One Exemplify how the Nations of the World Can Coöperate for Mutual Advantage on the Basis of Mutual Confidence and Understanding

The International Telecommunication Conference of 1947

Bartlett T. Miller

THE THREE international telecommunication conferences which were held concurrently at Atlantic City last summer were of importance to communication companies and agencies throughout the world.

The three were:—

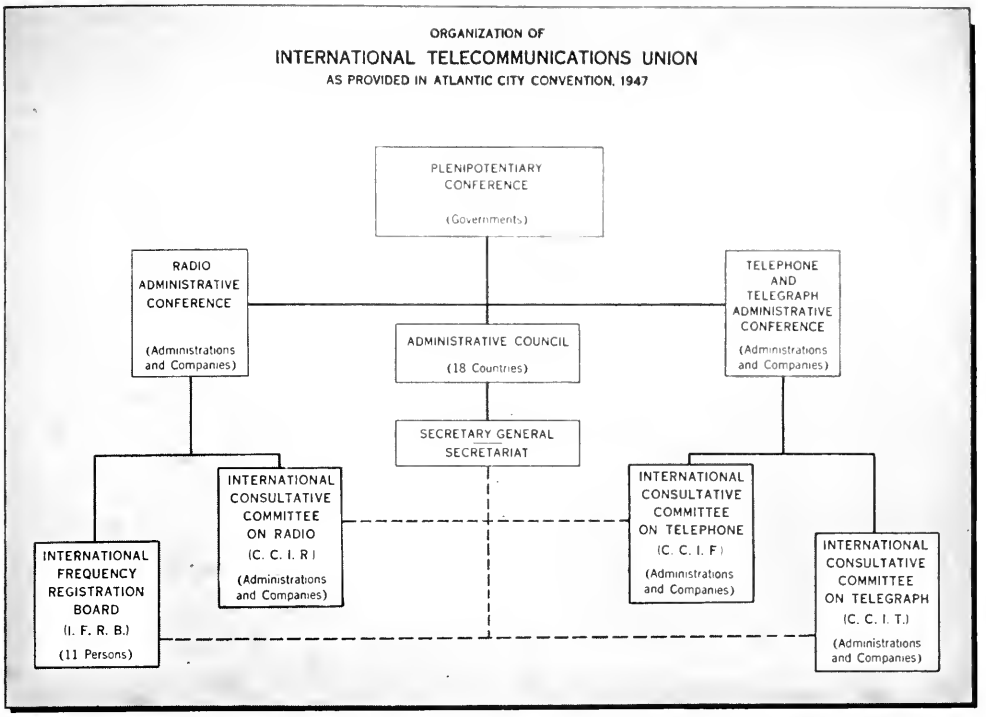
A Plenipotentiary Conference, which was concerned with the International Telecommunications Convention;

An Administrative Conference, which involved the Radio Regulations; and

A High-frequency Broadcasting Conference, which dealt principally with plans for the later discussion of high-frequency broadcasting.

The conferences were held in order that the International Telecommunications Convention, a multi-party treaty, and the International Radio Regulations, which are annexed to the treaty, could be brought up to date. The purpose of the treaty is to provide for solemn agreement among all countries on measures to avoid unnecessary radio interference and to regulate in other respects the conduct of international telegraph and telephone services, whether by wire or by radio. The last Plenipotentiary Conference was held in Madrid in 1932 and the previous Radio Conference in Cairo in 1938.

The frequencies used by all the radio services—ship-to-shore, aeronautical, broadcasting, point-to-point telephone and telegraph, etc.—whether commercial, private or military, and by all the countries of the world, must be harmoniously allocated and assigned, so that the ser-



vices of any one country will not cause interference with those of another country. It can readily be seen, therefore, that the problems are both technical and political.

Many countries have materially expanded their radio services since the 1938 Radio Conference in Cairo, and new techniques have been developed which extend the usable frequency spectrum far above the practical limits of that day. There were, therefore, new technical questions of an international character to be resolved. And, of course, everyone wants more frequency space for more services—more space in the aggregate than there is in the usable part of the electromagnetic spectrum.

THE UNITED STATES DELEGATION was under the jurisdiction of the State Department, and was headed by Charles R. Denny, Jr., of the Federal Communications Commission, as Chairman, and Francis Colt de Wolf, of the State Department, as Vice Chairman. These gentlemen were chosen also as chairman and vice chairman respectively of all three of the international conferences. The United States delegation included executives and experts from the various Federal departments and bureaus and a number of representatives of the telecommunications companies who acted as advisors. Altogether, the United States delegation consisted of about 175 people.

There were more than 400 representatives from 78 foreign countries. These foreign delegations ranged in size from one person to 33 persons. In addition, there were about 60 representatives present on behalf of some 20 international organizations such

as the International Radio Maritime Committee and the International Civil Aviation Organization. The secretariat of the conference, consisting of about 40 people, was headed by a staff from the Bureau of the International Telecommunication Union at Berne.

The International Telecommunication Union is made up of the countries which have signed or have otherwise adhered to the International Telecommunication Convention. The purposes of the Union, as provided in the Atlantic City treaty, are to extend international coöperation in telecommunication, to improve the efficiency of operation of telecommunication services, and to make them as widely available to the public as possible. To this end, the Union aims:

- to effect the allocation of the radio frequency spectrum and the registration of radio frequency assignments in such a way as to avoid harmful interference between radio stations of different countries;
- to foster the establishment of rates at levels as low as possible consistent with efficient service;
- to promote the adoption of measures whereby telecommunication services aid in ensuring the safety of life; and,
- to undertake studies, formulate recommendations, and publish information on telecommunication matters for the benefit of all members of the Union.

The activities of the Union have heretofore been supervised by the Swiss Government, but they are from now on to be managed by an administrative council of the Union consisting of 18 member countries. The Union maintains a general secretariat or bureau in Switzerland through which the correspondence of the Union is conducted and which compiles and publishes the appropriate lists of assigned frequencies and other data applicable to international communication services. The Union also provides a Director and a small specialized secretariat for each of three international consultative committees, which deal respectively with problems relating to radio, telephone, and telegraph communication.

Matters Affecting Telephone Service

THE CONFERENCES were organized on a committee basis.

For the radio administrative conference, for instance, there were ten committees. These ten were in turn divided into subcommittees, and these into sub-subcommittees, and so on; each to study one particular phase of the work of the conference.

Of the ten committees of the radio conference, we of the Bell System were particularly concerned in the work of six; and, as our group included five or six men who stayed in Atlantic City for substantially the entire period of the conferences, one of our representatives was assigned to follow the work of each of the important committees and in one or two cases one man covered additional committees. Certain members of our group also followed the work of three of the seven committees of the Plenipotentiary Conference.

Each representative took the responsibility for attending the meetings of his committee and its sub-

committees, for reading all of the proposals submitted by all of the countries which involved his committee, for analyzing each proposal to consider its effect upon the interests of the United States, and for advising with the United States Delegate on his committee as to what, according to his best judgment, the United States position should be.

Once a week, all the activities of the conferences were summarized briefly and informally, from individual reports which each member of our group made concerning the work with which he was concerned, for the current information of Bell System people in New York.

The Plenipotentiary Conference dealt with such matters as the relationship between the International Telecommunication Union and the United Nations, the way in which the activities of this Union should be handled during the interval between conferences, and the rules dealing with the participation in the periodic conferences by government delegations and by representatives of private operating companies and international organizations.

Among the articles of the convention which are of particular interest to those concerned with telephone service are the articles which relate to the prohibition of discrimination between users of international communication service, the priority which is to be given in the handling of certain government messages, the monetary unit to be used in the settlement of international accounts, and the emphasis on the secrecy of communications and the mutual avoidance of radio interference. The convention also includes a provision that the governments and the operating agencies may conclude special arrangements on telecommunication matters which do not concern the members

Before the main building of the A. T. & T. Company's overseas radio telephone transmitting station at Lawrenceville, N. J.: members of the conference who participated in the first inspection trip, on June 15. Represented in the group are Argentina, Belgium, Burma, China, Denmark, Finland, France, Hungary, Iceland, India, Iran, Italy, The Netherlands, The Netherlands East Indies, New Zealand, Norway, Poland, Portugal, Siam, Turkey, the United Kingdom, and the Union of South Africa—and the Long Lines Department and the Westrex Corporation

Operation of rhombic antennas is explained to a small group of visitors by means of a model layout in the Lawrenceville building

of the Union in general, with a proviso, however, against interference with the operation of radio services of other countries.

By action of the Atlantic City conference, the official languages of the International Telecommunication Union are hereafter to be Chinese, English, French, Russian, and Spanish. The working languages for the conduct of debates and issuance of publications during conferences are English, French, and Spanish.

At Atlantic City, much time was saved for the plenary sessions and larger committees through a system of simultaneous interpretation which enabled each listener to adjust a head set to concurrent interpretation in whichever of these three languages he desired. When, on some occasions, a speaker used Russian, his remarks were also interpreted and could be heard immediately in the other three languages. For the smaller committees, interpreters were available for consecutive repetition of remarks in the several languages.

The Atlantic City Convention is to become effective on January 1, 1949, at which time, for those parties who have ratified it, this Convention will supersede the treaty adopted at Madrid in 1932.

Radio Conference Committees

THE COMMITTEES of the radio conference, the subjects with which they were primarily concerned, the names of the spokesmen for the United States Delegation on the committees, and the names of the members of our Bell System group who coöperated with these spokesmen in the work of certain of these committees, were the following:

1—*Credentials.* This committee reveiwed the credentials presented by the govern-

ment delegations to the Conference to determine whether the scope of the authority given was adequate for the purpose of the Conference. The spokesman for the U. S. delegation was Francis Colt de Wolf, Chief, Telecommunications Division, Department of State.

2—*Steering.* This committee was a policy committee for the conduct of the conference, and consisted of the heads of the government delegations. The spokesmen for the U. S. delegation were the chairman and vice chairman of the delegation, Charles R. Denny, Jr., and Francis Colt de Wolf.

3—*Organization.* The organization committee dealt with the major points in which questions peculiar to radio were involved in the organization of the International Telecommunications Union. (The two principal questions dealt with were the establishment of an International Frequency Registration Board and the revision of the regulations applicable to the International Radio Consultative Committee. This committee is an advisory body which meets about every two years for the purpose of recommending technical standards and guides for the governments and operating agencies and for the International Frequency Registration Board.) The spokesman for the U. S. delegation was Harvey B. Otterman, Telecommunications Division, Department of State. The Bell System representative was Laurens E. Whittemore, O. & E. Department, A. T. & T. Co.

4—*Technical Coördination.* The purpose of this committee was to carry on any necessary coördination of the work of Committees 5, 6 and 7, which were all of a technical nature. The spokesman for the U. S. delegation was Commissioner E. K. Jett, Federal Communications Commission. The Bell System representative was Francis M. Ryan, O. & E. Department, A. T. & T. Co.

5—*Allocation of Frequencies.* This committee was concerned with the revision of the Frequency Allocation Table contained in the International Radio Regulations adopted at Cairo in 1938. Its problem was that of formulating an appropriate allocation of frequency bands for use by various services, such as point-to-point, maritime, aeronautical, broadcasting, amateur, etc. Its work was complicated by the divergent requirements and interests of the countries in various parts of the world and by certain uses of radio frequencies, particularly for navigational purposes and for high-frequency broadcasting, which had come into existence during the war period. The spokesman for the U. S. delegation was Captain Paul D. Miles, Federal Communications Commission. The Bell System representatives were Francis M. Ryan and Richard D. Campbell, O. & E. Department, A. T. & T. Co.

6—*Frequency List.* The Frequency Allocation Table adopted by the conference involves major changes in the frequency bands available to many of the services. It was the task of the Frequency List committee, therefore, to find a way in which the transition could be made from the Cairo allocation to the Atlantic City allocation with a minimum of disruption to international services. It was concluded to establish an international engineering body, known as the Provisional Frequency Board, for the purpose of preparing a new list of the operating frequencies to be used by all international radio stations for which requirements are submitted by the countries of the world. The International Frequency Registration Board is to take the new frequency list, after its approval by a special international radio conference, and thereafter consider whether assignments made by the different countries can be utilized without causing interference with the services for which frequencies have been previously recorded. The spokesman for the U. S. delegation was Captain Gordon L. Caswell, U. S. Navy. The Bell System representative was Douglas D. Donald, Long Lines Department, A. T. & T. Co.

7—*General Technical Regulations.* This committee was charged with the drafting

On the 800-acre rhombic-antenna "farm" at Lawrenceville the visitors are surrounded by antennas which are beamed to many points of the compass

of the definitions of certain technical terms used in the Convention and Regulations and with the formulation of technical standards relative to the band width of radio emissions, the permissible tolerance (i.e., departure of the actual emissions of radio stations from their assigned frequencies), and related questions. It also recommended the utilization of arrangements for monitoring or measuring the frequencies on which the actual operation of radio stations takes place and the reporting of such observations to the International Frequency Registration Board for publication. The spokesman for the U. S. delegation was Dr. J. H. Dellinger, National Bureau of Standards. The Bell System representative was Frederick B. Llewellyn, Bell Telephone Laboratories.

8—*Operating Regulations.* This committee reviewed and revised the radio operating provisions which were included in the Cairo Regulations, particularly those applicable to the maritime service. These provisions related primarily to the establishment of contact with ships and aircraft, to the handling of distress communications, and to the requirements for various classes of radio operators. Both telegraph and telephone communication were involved. The spokesman for the U. S. delegation was Commodore E. M. Webster, Commissioner, Federal Communications Commission. The Bell System representative was Richard D. Campbell, O. & E. Department, A. T. & T. Co.

9—*Drafting.* The drafting committee was most active toward the close of the conference, as its function was to receive the texts of regulations and recommendations adopted by the other committees and, without changing their substance or meaning, to put them in proper form for adoption by the conference. The spokesman for the U. S. delegation was Arthur L. Lebel, Telecommunications Division, Department of State.

10—*Auditing of Report of the International Bureau.* This committee reviewed the report of the financial operations of the

International Bureau prior to approval by the conference. The spokesman for the U. S. delegation was Harvey B. Otterman, Telecommunications Division, Department of State.

Decisions Reached

AMONG THE important decisions applicable to radio were:

- Adoption of a new table of allocation of frequency bands to services;
- Formulation of plans for the preparation of a revised list of frequency assignments in the high-frequency spectrum for the radio stations of the world based on engineering principles, including arrangements for additional conferences to carry this work forward;
- Agreement to establish an International Frequency Registration Board whose function would be to: A), maintain a registry of all international frequency assignments for all the countries; and, B), render advice to the members of the International Telecommunication Union with a view to the operation of the maximum number of radio channels in those portions of the spectrum where international interference may occur;
- Agreement that there should be monitoring of such assignments in order to: A), determine the sources of any interference with recognized assignments; and, B), disclose deviations in uses of radio frequencies from those which are set forth in the Atlantic City regulations.

The fact that it was possible to reach agreement on a new Frequency Allocation Table shows that there is world-wide recognition of the necessity of collaboration for the avoidance of interference in the operation of international communication services. The major portion of this table is not to become effective, however, until after there has been an opportunity to review the work of the Provisional Frequency Board in the establishment of the new frequency assignment list. Moreover, the machinery established by the Atlantic City conference for dealing with the problems of radio interference and frequency assignments in the future will have to undergo a period of trial before a definite conclusion as to its effectiveness can be reached.

THE EMPHASIS which has been placed on the necessity of applying the most expert technical knowledge and experience to the solution of these problems through the continuing activity of the International Radio Consultative Committee and the permanent International Frequency Registration Board will, it is hoped, result in making more channels available for international communication and in a reduction of radio interference.

The overseas telephone service of the Bell System requires frequencies in the bands allocated to fixed or point-to-point service, and these bands have been substantially reduced in size in order to make room for expanding aeronautical and broadcasting operations. The employment of improved techniques by all agencies utilizing these bands is therefore particularly important to the point-to-point services.

The frequency allocations made to the maritime services are such as to

offer an oportunity for the further development of marine radio telephone service, although some reorganization of the coastal harbor service may be required as a result of the designation of a specific frequency (2182 kilocycles) for calling and distress purposes in marine telephone operation.

The requirements for radio telephone operators' certificates were brought more fully into line with the operating practices which are made possible through the use of equipment of the modern "push button" type on ships and aircraft.

THE International Telegraph and the International Telephone Regulations, which are annexed to the Madrid Convention, were not revised at the Atlantic City conference. A separate International Administrative Conference is scheduled to be held in 1949 for the purpose of dealing with these regulations.

The International Telegraph Regulations treat largely of operating rules and practices which are the direct concern of the operating agencies which furnish the service, including the communication companies in the United States; and the International Telephone Regulations are at present such as to be applicable only to the European region. The United States Government has heretofore not been a party to either of these sets of Regulations. The Atlantic City Convention provides that the Telegraph and Telephone Regulations as well as the Radio Regulations shall be

Inspecting the new overseas switchboard in the Long Lines headquarters building in New York

In the overseas control room

binding on all members of the International Telecommunications Union unless specific reservation is made to the contrary. The United States delegation at Atlantic City made such a reservation, formally declaring that by signing the Atlantic City Convention the United States did not accept any obligation in respect of the Telegraph Regulations or the Telephone Regulations.

The questions involved in possible adherence by the United States Government to either the Telegraph or the Telephone Regulations are far-reaching and will require further careful study on the part of both the government and the companies.

THE CONFERENCE as a whole lasted for 20 weeks.

The Radio Administrative Conference started on May 15, the Plenipotentiary on July 1, and the High Frequency on August 16. The High Frequency Broadcasting Conference adjourned on September 27, and the Radio and Plenipotentiary Conferences were concluded on October 2 with the signing of the new Radio Regulations and the new Treaty or Convention.

During this time there were issued over 1,600 numbered documents containing proposals, reports of meetings, etc., involving in all about fifteen million pages of mimeographed material.

Atlantic City was chosen as the location for the conferences for the very practical reason that it was the only available place which could accommodate for three or four months their more than 700 members, whose work would be done by a score of committees for which many conference rooms would have to be provided. And it worked out very well

Inspection completed: These visitors have been examining the antennas, atop the Long Lines building, of the New York–Boston radio relay system, which had not then been placed in commercial operation

after one got used to it—although some of the foreign visitors would have been happy if they had had more opportunity to see other parts of the country.

The conference was organized on the basis of a six-day week except on certain week-ends when other activities were planned, and the committee meetings and delegation conferences had to be scheduled at hours when conference rooms were available and when there was no conflict with other important committees on which delegates might be sitting. The work day stretched out to late evenings, therefore, and frequently until after midnight, so that the 20 weeks were a grind for all the participants.

The United States communication companies did what they could to help the foreign delegates enjoy their stay in this country.

A series of week-end trips was arranged by A. T. & T. which took comparatively small groups on visits to Bell System installations in the vicinity: the overseas radio telephone transmitting station of the Long Lines Department at Lawrenceville, N. J., the Long Lines headquarters building at 32 Avenue of the Americas in New York City, and the buildings of the Bell Telephone Laboratories in New York and at Murray Hill, N. J. On one occasion, all of the United States communication companies assisting at Atlantic City joined together and brought over 700 to New York for a week-end of sightseeing. A dinner was given at the Waldorf-Astoria at which President Walter S. Gifford of the A. T. & T. Co. presided on behalf of all the companies. With him at the head table, from commercial organizations, were

David Sarnoff, president of the Radio Corporation of America; A. Warren Norton, then president of Press Wireless Inc.; Joseph L. Egan, president of Western Union Telegraph Company; F. T. Caldwell, president of International Standard Electric Corp., representing Sosthenes Behn, president of the International Telephone and Telegraph Corporation; and R. V. Howley, president of Tropical Radio Telegraph Company.

Our own group endeavored to become acquainted with the members of the foreign delegations, particularly from the countries where A. T. & T. has overseas connections, and we had extremely pleasant evenings with the British, French, Chinese, Russian, Swedish, Portuguese, Danish, Swiss, and other groups. I personally found it very stimulating to be so closely associated with our fine group of Bell System representatives: W. G. Thompson, of the Long Lines Department, who was in many respects the active head of the group; L. E. Whittemore, who handled the administrative side of our office in addition to work on the committees; and F. M. Ryan, R. D. Campbell, D. D. Donald, F. B. Llewellyn, and E. S. Hawley. Their knowledge and energy were frequently of service to the United States chairman as well as to several of the foreign delegates. Someone was technically qualified to assist the United States delegation on almost any question that arose and, individually and as a group, they made appreciable contributions to the work of the conferences.

The Bell Telephone Laboratories at Murray Hill, N. J., were the last stop for conference members before their return to Atlantic City

Opening of New York-Boston Radio Relay System Is Historic Event

THE BELL SYSTEM'S radio relay system between New York and Boston, which hurls telephone conversations and television images along a narrow path of space with energy-renewing boosts from stations on the tops of seven hills en route, was opened for experimental use on November, 13, 1947.

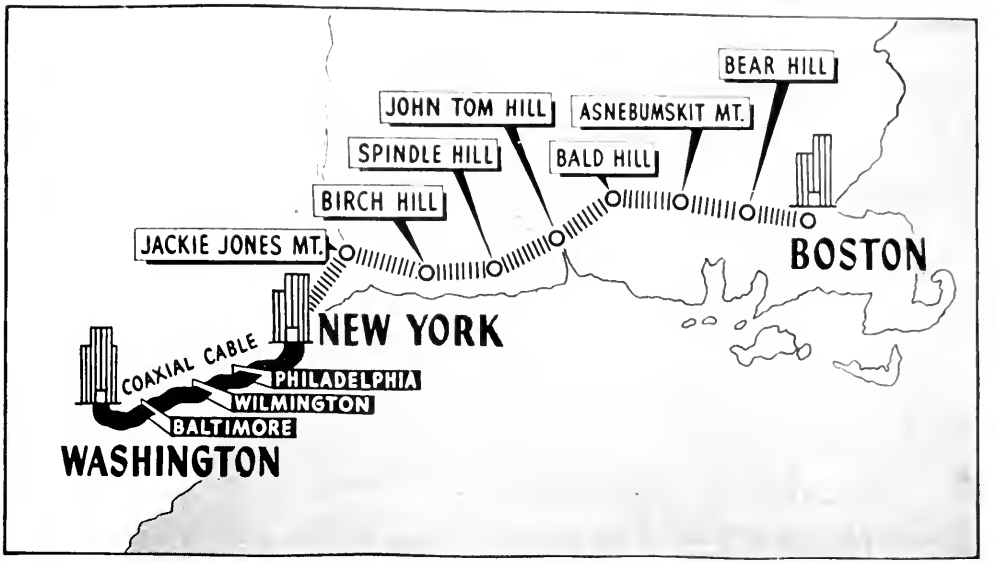
Simultaneous ceremonies in New York, Boston and Washington—including a television program carried on the longest television network in existence—were linked by a circuit combining the new radio relay and the coaxial cable between New York and Washington, D. C. The first telephone call, officially opening the radio relay system, was made by Walter S. Gifford, president of the American Telephone and Telegraph Company, who talked with Joe E. Harrell, president of the New England Telephone and Telegraph Company, in Boston. Speaking from Washington Paul A. Walker, acting chairman of the Federal Communications Commission, and H. Randolph Maddox, president of the Chesapeake and Potomac Telephone Companies, joined the conversation.

As host to representatives of the press and radio and television executives, at the ceremonies in New York, Frank P. Lawrence, vice president of the A. T. & T. Co. in charge of the Long Lines Department, introduced the intercity television broadcast. The program was seen by audiences in all cities along the East Coast having television broadcasting stations. The stations broadcasting the program were: WABD, WCBS, and WNBT in New York; WFIL-TV and WPTZ in Philadelphia; WMAR-TV in Baltimore; WMAL-TV, WNBW, and WTTG in Washington; and WRBG in Schenectady. The television network was about 500 miles long, and made it possible to bring programs to a potential viewing audience of about 25 million people.

Titled "The Story of Seven Hilltops," the television broadcast began in New York, where Mr. Gifford, Carl Whitmore, President of the New York Telephone Company, and Mr. Lawrence participated in the early part of the program. The scene then shifted to Boston, to Mr. Harrell, whose image traveled by radio relay to New York, and beyond to Philadelphia, Baltimore, and Washington by coaxial cable. Next, Mr. Maddox and Mr. Walker, in Washington, joined the program and were seen on television screens in other cities of the network. Tom Shirley, announcer for the Bell System's "Telephone Hour," who was master of ceremonies, concluded the television broadcast in New York.

Following the television broadcast Dr. Ralph Bown, Director of Research at the Bell Telephone Laboratories, conducted a technical demonstration of the radio relay system for the audiences in New York and Boston. Special test films were sent to Boston and back over the microwave beam, and, in a final demonstration, all channels were connected together to transmit a picture twice around the intercity loop for a total distance of nearly 1,000 miles.

As the inaugural program came to an



The Bell System's coaxial cable and radio relay routes between Washington and Boston

end, guests at the New York auditorium were invited to try out the radio relay system themselves. Using a dozen telephones operating simultaneously on the microwave circuits, they talked to colleagues and friends attending the ceremonies at Boston.

In the clarity of the telephone conversations and television images, the seven hilltops had told their story well. And the audience had seen a tremendously intricate job of coordinating conference circuits, sound and video channels, cameras and microphones.

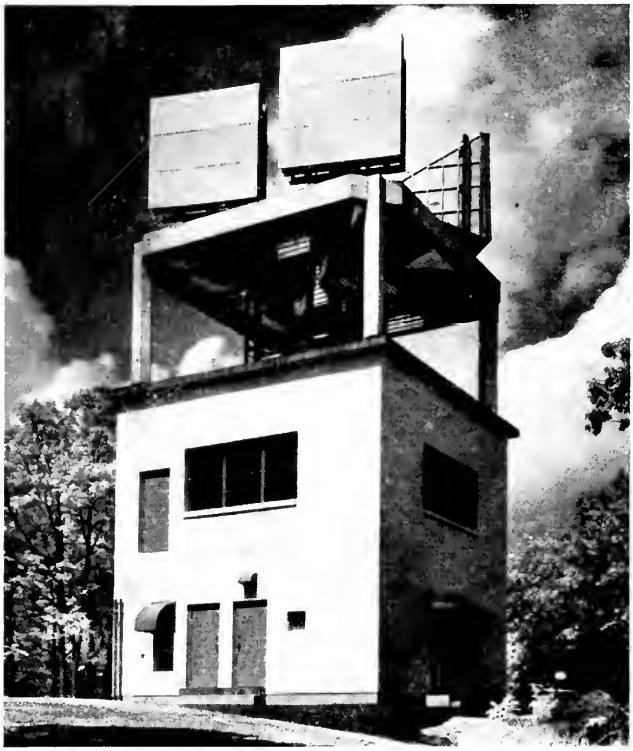
Micro-wave Radio Relay In the Bell System

MICRO-WAVE RADIO RELAY SYSTEMS of the New York-Boston type are basically a means of transmitting large amounts of information—for example, many different conversations—simultaneously over long distances. Using broadband radio beams rather than wire or cable, they provide dependable, high quality communications circuits on a large scale: hundreds, conceivably thousands, of telephone circuits and, if necessary, many television channels. Such circuits can also carry radio programs, teletype, and telegraph.

The New York-Boston system was built to provide a full-scale field trial of radio relay as a part of the Bell System communications network. When development is completed, it is expected to furnish intercity facilities for long distance telephony, television transmission, and other services. Designed to supplement wire or cable lines between cities, the system is another step forward in the Bell System's continuing effort to increase the flexibility and efficiency of its over-all network.

The two terminal points of the radio relay system are the headquarters building of the A. T. & T. Company's Long Lines Department at 32 Avenue of the Americas in New York and, at Boston, the Bowdoin Square building of the New England Telephone and Telegraph Company.

Between terminal points, the micro-wave beam makes eight jumps via seven intermediate radio relay stations spaced about thirty miles apart. To provide the unobstructed view between antennas necessary in micro-wave transmission, the sta-



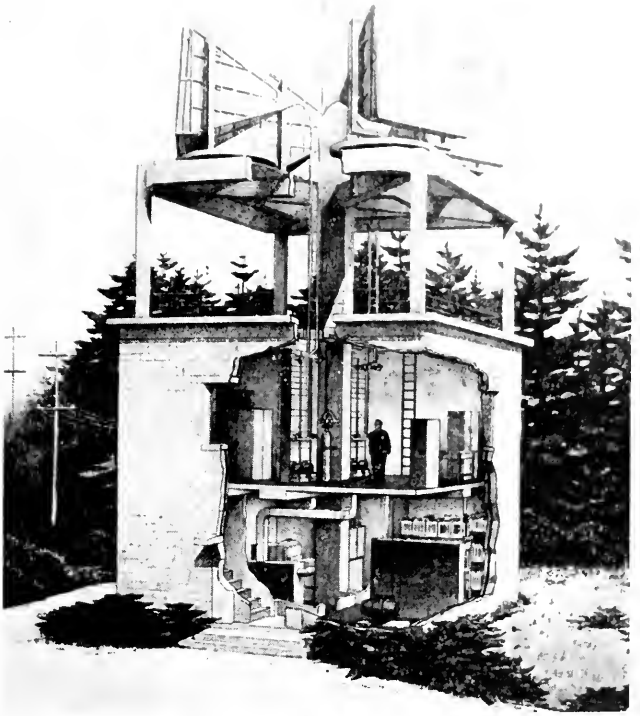
One of the seven intermediate hilltop stations along the route of the Bell System's new radio relay system between New York and Boston. Electro-magnetic lenses in the four horns atop the buildings receive and transmit long distance communications between the two cities. This is the station on Jackie Jones Mountain, near Haverstraw, N. Y.

tions are built on hilltops: Jackie Jones Mountain, five miles west of Haverstraw, N. Y.; Birch Hill, about three miles south of Pawling, N. Y.; Spindle Hill, five miles north of Waterbury, Conn.; John Tom Hill, at Glastonbury, Conn.; Bald Hill, five miles east of Stafford Springs, Conn.; Asnebumskit Mountain, five miles northwest of Worcester, Mass.; and Bear Hill at Waltham, Mass.

On the roof of each radio relay station are four antennas, two facing along the route toward New York, two facing along the route toward Boston. This allows for two-way operation—with one antenna of each pair for transmitting, the other for receiving. The antennas are ten feet square and incorporate a metal lens capable of focussing the micro-wave signals into a beam sharper than that provided by an anti-aircraft searchlight.

At each station there are repeaters, or amplifiers, to keep the signals up to the proper strength as they are relayed along to the next station. Signals are carried from the receiving antenna to the repeaters and out again to the transmitting antenna through hollow metal pipes called wave guides. There are four such pipes at each station: one associated with each of the four antennas.

The first floor of each radio relay tower contains heating and ventilating equipment, as well as an emergency battery and power



Cut-away view of a typical radio relay station between New York and Boston, showing the arrangement of equipment in the building. Emergency power equipment and storage batteries are on the first floor, radio equipment on the second floor, and the special microwave antennas which receive and beam the communication signals are on the roof

generator to give double protection against failure of the power supply.

The initial equipment comprises a regular and a spare circuit in each direction. For operation of these two circuits, frequencies in the range 3700 to 4200 megacycles have been assigned by the Federal Communications Commission. Each circuit carries a signal band width of about five megacycles. Such a band can handle hundreds of telephone conversations, or a television program.

Terminal equipment capable of carrying 240 simultaneous telephone conversations will be installed for experiment next spring, and it is expected that more channels will be added later.

Plans are well under way for a radio relay system to connect New York and Chicago via Philadelphia, and completion is scheduled for 1949. This will contain new developments for better operation and greater carrying capacity—even over the longer distance involved.

Modern Radiotelephone, Teletypewriter, and Telephone Services Are Invaluable Aids in the Apprehension of Criminals and even in the Prevention of Crime

"Arms of the Law"—Police Communications

Richard B. Holt

"At 2 o'clock this morning, slumbering residents in the vicinity of Fifth and Main Streets were awakened by the sharp raps of a nightstick on the sidewalk, as Patrolman J. J. Murphy summoned aid in apprehending a burglar who had . . ."

From a news item of 1920.

"With the capture of four yeggmen in a third floor loft at Chestnut and Elm, early this morning, police believe they have broken up the wave of safe cracking which has terrorized business men in this neighborhood for several months. The reason for the gang's elusiveness, according to police, was their use of 'walkie-talkies' between a look-out posted on the street and other members of the gang in a nearby building. But three police cars, alerted by radio, converged . . ."

From a news item of 1947.

FROM RAP of policeman's nightstick to radio! Here, in dramatic contrast, is a summary of the progress that has taken place in police communications over the past quarter of a century.

Put radio together with the telephone, its older brother, and the teletypewriter, and you have the "arms of the law":—arms which reach into every community and are a major force in helping to provide protection of life and property.

In these days, when criminals take to "walkie-talkies" in executing crimes; and fast cars, good roads, and even the airplane provide means of escape, fast communication is becoming more and more a necessity in police work.

The "arms of the law" must be quick, strong, dependable arms. The job of making them so is a joint responsibility of police and telephone people everywhere.

The role of communications in police work is really two-fold. Its part in the apprehension of criminals

can be readily visualized; but, in addition, a fast and efficient police communication system often acts as a deterrent to crime. A potential criminal may think twice if he knows that the odds are stacked against him by a police force equipped with the latest developments in communications.

How all three types of communications aid in the constant war against crime is an interesting story.

A Pennsylvania State Police patrolman reaches for the radiotelephone with which his patrol car is equipped

LET'S CONSIDER first the radio. While the telephone and teletypewriter provide police with excellent means of fast communication between fixed points, police must be able to reach farther—to the patrol cars and other mobile units which are often responsible for executing the final police job. Here the mobile radiotelephone is invaluable.

Take the case of a recent hold-up at a lonely gas station on the outskirts of one of our large cities.

The attendant was shot and killed by the nervous gunman. A passing motorist, chancing on the scene just as the hold-up man was escaping, called the police from the gas-station telephone and gave an excited story of the murder. Within a few seconds, a radio patrol car on duty near the scene of the crime was dispatched by radio to the spot. Quickly and coolly the radio patrolman questioned the frightened witness: "What make of car was used?" "Did you see the license number?" "Which way did he go?"

Then, without losing a precious minute, the radio car sped in pursuit. While the police driver handled the car, his companion was talking with headquarters over the radiotelephone attached to the dashboard. Quickly a resumé of the crime was reported, and request made to headquarters to dispatch other patrol cars to block all avenues of escape.

In less than an hour from the time of the crime, the fugitive was in police custody and word had been flashed back to headquarters by radiotelephone in order to release police efforts for other assignments.

Reports of similarly spectacular arrests are contained in the files of police throughout the country who

have the advantage of this modern aid to police work.

Early One-Way Experiments

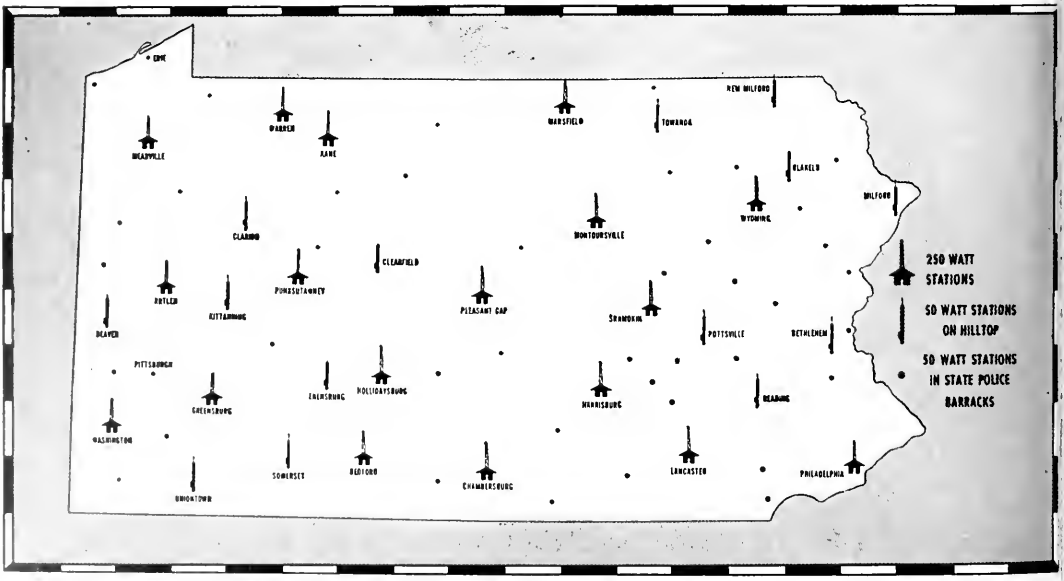
THE STORY of the radiotelephone in police work actually dates back to 1921, when the Detroit Police Department started experiments with one-way radio transmission for dispatching patrol cars. Since that time the technique of the art has been developed to facilitate two-way transmission, enabling the mobile unit to converse with the land station, and even three-way communication, which in addition permits mobile units to talk directly with each other.

For some years the Western Electric Company, as well as other manufacturers, has supplied radiotelephone equipment for private systems owned by police departments.

In 1945, some of the Bell System operating companies began to explore the field of leasing private mobile radiotelephone systems. As in the private-line services regularly offered by the telephone companies—such as telephone, teletypewriter, telegraph—all facilities, both fixed and mobile, are provided and maintained by the telephone company under contract, for the individual use of the customer.

Today, less than three years after the first installation, some 30 state, county, and municipal police agencies are leasing private systems from Bell telephone companies. These systems involve more than 1000 radio-equipped vehicles. Many more systems are being actively considered.

There are many advantages, these customers believe, in leasing such systems from the telephone company rather than establishing privately-



Backbone of the new Pennsylvania State Police radiotelephone system are the 73 fixed radio transmitter-receivers located throughout the state

owned systems. For instance—

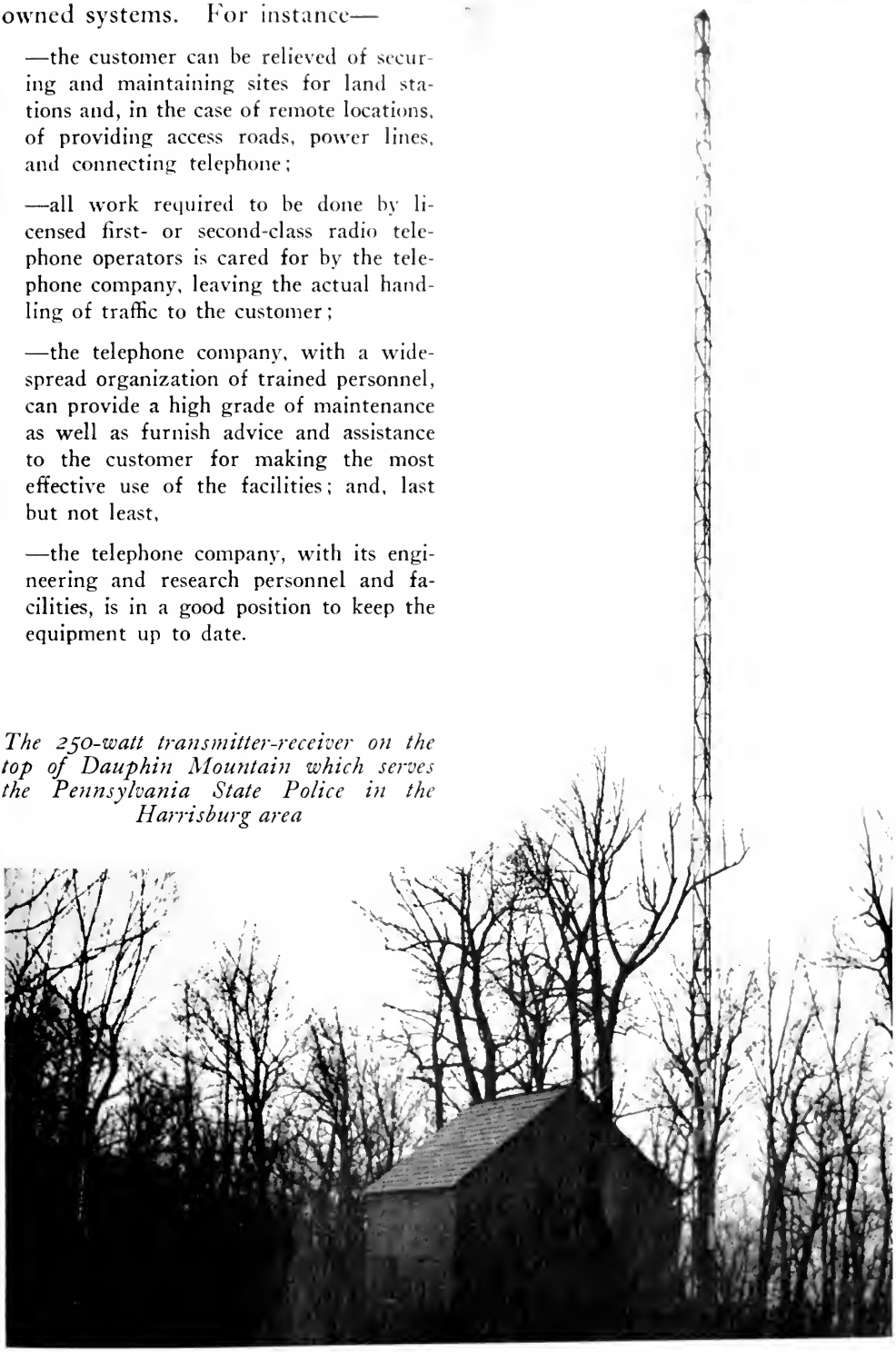
—the customer can be relieved of securing and maintaining sites for land stations and, in the case of remote locations, of providing access roads, power lines, and connecting telephone;

—all work required to be done by licensed first- or second-class radio telephone operators is cared for by the telephone company, leaving the actual handling of traffic to the customer;

—the telephone company, with a widespread organization of trained personnel, can provide a high grade of maintenance as well as furnish advice and assistance to the customer for making the most effective use of the facilities; and, last but not least,

—the telephone company, with its engineering and research personnel and facilities, is in a good position to keep the equipment up to date.

The 250-watt transmitter-receiver on the top of Dauphin Mountain which serves the Pennsylvania State Police in the Harrisburg area



Pennsylvania's Radio Network

A LARGE private mobile radio system, such as the system recently installed by the Bell Telephone Company of Pennsylvania for the Pennsylvania State Police, presents many problems.

This famous police organization, directed by Col. C. M. Wilhelm, has its headquarters at Harrisburg and is divided into four squadrons. Each of these squadrons is responsible for police activities within a certain geographical area. The squadrons, in turn, are subdivided into troops, with a troop headquarters responsible for activity in each troop area.

The basic problem was to provide a system so designed that each troop headquarters could maintain two-way communication with all mobile units within its area, and also permit one mobile unit to talk with another nearby mobile unit while headquarters "listened in." Sounds easy? Not when you remember Pennsylvania's 45,000 square miles of terrain, with enough hills and valleys to keep a radio engineer's slide rule busy.

Literally thousands of computations had to be made to determine the most advantageous sites for transmitters and receivers before installation could begin. For the network in its entirety provides a total of 73 radiotelephone land stations and more than 250 police cars equipped with two-way sets. Eighteen of the land stations, with 250-watt transmitters, are installed in specially erected brick buildings on mountains or hill tops. The rest, with 50-watt transmitters, are mounted on strategically located poles or in police barracks.

Combined with the radiotelephone system is the State Police teletypewriter network, which had its beginning in 1930. Considerably expanded since then, this network now serves as a link between state police radio dispatchers located in the troop areas, in addition to its major function of handling thousands of messages a day between some 60 state police locations and transmitting bulletins to more than 60 municipal or county police teletypewriter machines.

Should a troop headquarters radio station wish to enlist the aid of police units outside its area, a message is sent over the teletypewriter network to radio dispatchers in other cities. Here, it is broadcast by radiotelephone to local patrol cars in the area —an example of how radio and teletypewriter services can be effectively integrated.

ANOTHER large private radiotelephone system has been engineered recently by the New York Telephone Company for the New York State Police, headed by Supt. John A. Gaffney.

Headquarters of the New York State "troopers" is at Albany, and authority fans out to six troop areas. These troops in turn are divided into zones, which include one police station designated as zone headquarters and certain substations known as 24-hour stations.

Normally, zone headquarters maintains direct two-way communication with all mobile units within its area. However, there are occasions when a troop headquarters station may

The radiotelephone dispatching layout of the Newark, N. J., municipal police. The officer at the right is pointing to the lamps on the wall map, each of which represents a radio-equipped patrol car and indicates its status

wish to coördinate directly the activities of all police cars under its jurisdiction. Hilly terrain makes such complete radio telephone coverage over a broad area from a single transmitter extremely difficult. So, to enable a troop headquarters station to establish two-way communication with all cars in its area, the system includes a network of land-line telephone channels for interconnecting radio transmitters and receivers. Thus the path would be from troop headquarters over the wire network and thence out over radio facilities to the police cars. Return communication from a mobile unit would be picked up by the nearest receiver and fed back over the wire line to headquarters.

These wire lines are versatile, too. When not in use for broad radio coverage, they may be used to provide telephone communication between land stations.

The New York State Police radiotelephone system, like that of Pennsylvania, will provide for communication not only between mobile units and land stations, but also between mobile units. When completed, the system will serve more than 400 police automobiles. In addition, 42 "walkie-talkie" sets will be provided, and two police boats, operating on the St. Lawrence River and Lake Champlain, will be equipped with mobile radio sets. Sixteen portable transmitter-receivers also will be available for emergency use. This radiotelephone system is backed up by a network of private line teletypewriter circuits connecting more than 160 machines throughout the state.

While there are problems aplenty in designing police radio telephone systems, operating them effectively also is a sizable job. A big-city police radio dispatcher is a busy man.

In Newark, N. J., for instance, he sits behind a large horseshoe-shaped desk. In front of him are a radio microphone and loudspeaker, and at his right a series of buttons, mounted on a panel. These buttons control small lamps mounted on a huge wall map, which shows the entire municipal area. Each lamp represents a radio-equipped patrol car. As a car is dispatched to the scene of an emergency, pushing the proper button lights the lamp indicating that the car is on an assignment.

As other calls come in for police aid in the same area, the dispatcher can tell at a glance the location of the nearest available patrol car and send it to the scene. When patrol cars call back to headquarters to report completion of an assignment, the lamps are extinguished, indicating that the cars are available for other jobs.

Telephone calls for assistance from the public are taken down by four patrolmen seated at a flat desk in the same room. In front of them, recessed in the desk, are rows of keys giving access to lines from the police headquarters telephone switchboard over which the calls are received.

A brief description of the emergency is noted on a slip of paper and passed to the dispatcher. A quick glance at the master map indicates the disposition of available cars and enables the police officer to dispatch the nearest vehicle directly to the scene in a matter of seconds.

These radio patrol cars are well equipped units. When we call "Police" we do not necessarily want just a man in uniform with a gun. Perhaps a serious automobile accident has occurred and people have been injured. The police car, often the first to reach the scene, must be able to give aid quickly and efficiently.

To meet such daily emergencies, some police departments equip their patrol cars with items that seem strange when one thinks of police protection in only its limited sense. A list of standard equipment might include, for instance, fire extinguisher,

Radio-equipped patrol cars of Newark's police department

first-aid kit, heavy jack, crowbars, axes, safety flares, and even a dog-catcher's net.

STILL ANOTHER FORM of ratiotelephone service is available to police organizations: the telephone companies' regular public offering, mobile telephone service.

This service, first offered at St. Louis in June, 1946, is really an extension of the regular local and toll telephone service, by means of radio, to mobile units. Subscribers to this service have, by means of two-way radio telephone sets installed in their cars, access to any other customer of the Bell System whether served by wire or radio channels.

Police in smaller communities—about 50 of them today—have found this service attractive, especially where the cost of leasing or owning a private system might strain the local budget. This form of mobile service has the further advantage of enabling the public or police officials to communicate directly with patrol cars from any telephone.

The City and the Telephone

DESPITE the importance of radio and teletypewriter, the telephone is still the backbone of police communications. It is the chief link between the public—you and me—and the police. "Call the police" when an emergency occurs is practically synonymous with "telephone."

Telephone arrangements for police must be designed differently from those of the average user. When the frantic householder tries to summon police in the middle of the night as a burglar is forcing open a downstairs window, seconds seem like hours, and delays mean danger. Yet calls from the public are predominantly of this type. We seldom need police assistance except in an emergency.

Recognizing this, police communication officers want plenty of central-office lines ("trunks") so that there will be a minimum number of "busies" when the public calls. They also try to provide sufficient personnel and telephones to answer these calls with an absolute minimum of delay.

What happens at the police end of the line when you call them varies widely. It is one thing in a village police or county sheriff's office, something else again in a St. Louis, or a Boston, or a New York City.

In a typical day in Manhattan, for instance, more than 2000 incoming calls, mostly emergency, are handled over the headquarters "alarm turret," and many of these calls in turn set up a chain reaction involving other calls within the police organization itself.

To illustrate what goes on behind the scenes in a big-city police organization, let's look at the set-up provided by the New York Telephone Company for the New York City police, headed by Commissioner Arthur W. Wallander. Divided as it is into five boroughs and 105 precincts, New York City presents a really complex problem for efficient police coördination.

The police and the telephone company have together worked out a plan whereby all calls for assistance are routed immediately to the police headquarters of the borough in which the call originated. By dialing the operator and asking for "police," a

The alarm turret (right) and administrative switchboard (left background) of the New York City Police Department at headquarters of the Borough of Manhattan

citizen is connected immediately to a special "alarm turret" at borough police headquarters. At 240 Center Street, headquarters for the Borough of Manhattan, for instance, the call would come in over one of 21 trunk lines from a telephone central office to a switchboard connecting with almost 200 telephones and manned by 12 patrolmen.

Here the reassuring voice of a specially trained policeman calms the excited caller, and gets all the information available about the exact location and nature of the emergency.

Thus communication is directly with police officers who can themselves initiate any necessary action. There is no confusion from transfer of calls to other offices, no repetition of lengthy information when seconds may save lives.

What the police telephone attendant does after getting one of these calls depends on the nature of the emergency. Should it be an automobile accident which also results in a fire, he has direct access, over the lines appearing in the alarm turret, to the Fire Department and city hospitals. For other emergencies tie-lines or extension lines to the gas and electric companies and other police units such as Homicide Bureau, Riot Squad, Detective Bureau, Radio Dispatcher or Teletype Room provide immediately available channels for help.

Here, too, are terminated tie-lines or extension lines to all police precincts within the borough limits, so that effective contact with all protective forces can be made by the flick of a key.

While emergency calls are first in importance, they aren't the only calls that police receive. Running a big-city police organization is big business. There are thousands of daily calls other than emergency: detectives calling in to report on assignments, welfare agencies discussing cases, police officials calling headquarters, and similar matters.

In order to leave the "alarm turret" free at all times for emergency use, the administrative business is carried on over a separate switchboard also located at 240 Center Street. This board, with more than 40 lines to the telephone central office and over 270 stations, is connected by tie-lines with the alarm turret. This flexible arrangement permits the transfer of any calls received at the administrative switchboard to the alarm turret quickly when emergency action is needed.

The radiotelephone and teletypewriter room of the Ohio State Highway Patrol district headquarters at Findlay, O.

Telephone access to police protection is not limited to subscribers calling from home or office however, for New York police have spotted over 1700 police call boxes throughout the city. These green boxes with the lettering "Use this telephone to call Police" are unlocked and available to any citizen. Direct lines link them to the nearest police precinct station house.

TAKING LESSONS from experience and trying to anticipate the unforeseen are two of the factors that go into the planning of all police communication arrangements, large and small.

This is true in Newark, N. J., for instance, where police protection for over 400,000 citizens is provided under the supervision of John B. Keenan, Director of Public Safety. At Newark police headquarters, the normal complement of trunk lines to the nearest telephone company central office is supplemented by seven additional lines to another central office on the outskirts of the city. Should some unforeseen disaster "jam" the central office which normally serves the headquarters switchboard, calls can be received over this alternative route. These facilities also provide outgoing service during hours when the regular lines become busy with incoming calls.

Here, as in all well-planned police systems, the emergency nature of the communication is the prime consideration. All facilities—switchboard positions, trunk lines, extension lines, etc.—are provided in sufficient quantity for peak volumes, to assure adequate protection under all conditions.

At the other end of the scale are the communities which are too small to maintain a police headquarters office manned 24 hours a day. For such communities, a special arrangement has been worked out, which

Teletypewriter equipment in the headquarters at Columbus of the Ohio State Highway Patrol, of which Col. George Mingle is superintendent

involves a combination of radio and special reversed-charge toll service.

During hours when the local police office is not open, police protection for the community is usually maintained by one or more patrol cars connected with state or county radio systems. The problem is to provide means for getting requests for emergency police assistance *from* the various towns and small communities throughout the county *to* the radio center in the shortest possible time and at minimum cost.

In such cases, the procedure is something like this. The telephone company operator, upon receiving a call for police assistance, attempts first to complete the call to the local police station. If the station does not answer, the operator completes the call to the state or county radio center. At the radio center a policeman takes down the details of the call and, if necessary, gets in touch by radio with the mobile unit nearest the community where the call originated. Charges for the toll call are billed to the local police agency, not to the citizen placing the call.

Teletypewriter: the Third "Arm"

While the telephone provides contact between the general public and the police, and radio the means whereby mobile units are controlled, there is yet a third link in the chain of police communications. This is the job of spreading alarms quickly over large areas: of coördinating the activities of police units within a city, within a state, and even between states, to produce a smoothly functioning team. This role is filled by the third "arm of the law"—the teletypewriter.

Teletypewriter service provides the medium for transmitting quickly and accurately the detailed information necessary in today's police work.

In addition to "broadcasts" and "alarms," this service is used by police for missing person reports, gun checks, stolen car reports, license checks, and many other matters which play a part in the day-to-day war on crime.

The use of the teletypewriter in police work dates back some twenty years, when a group of towns in Connecticut got together and subscribed for teletypewriter service to coördinate the activities of their separate police agencies. From this small beginning in 1927, the use of this communication medium in police work has grown until today networks of police teletypewriter circuits covering more than 373,000 square miles are protecting more than 54,000,000 citizens.

Among the reasons for the widespread use of teletypewriter service in police work, the outstanding ones are: *speed*, which provides a quick means of closing avenues of escape to criminals; *accuracy*, which minimizes errors in license numbers of stolen vehicles or in the description of wanted persons; and a *written record*, valuable for reference purposes and for establishing the responsibility for police action.

Along the eastern seaboard and extending westward through Ohio, eleven states and the District of Columbia have private line teletypewriter systems linking police units within their boundaries. Private line channels from these systems also reach to state police headquarters in two additional states.

Each state system connects with those of adjacent or nearby states, and also with municipal and county teletypewriter systems within the state, to form a coördinated network —known as the Eastern States Police

Teletypewriters at the headquarters of the New York State Police teletypewriter system, at Albany

Teletypewriter Network. Over these facilities it is possible to flash an alarm in a matter of minutes to almost 1,000 teletypewriter machines throughout the area.

In addition, there are scattered county and municipal teletypewriter systems not directly connected with the Eastern States Network. One of the largest is in Wayne County, Michigan, where some twenty communities are connected by private-line teletypewriter service.

In California there is a state-wide network of over 3,600 miles of private-line teletypewriter circuits connecting more than 90 machines.

Between the Eastern States Network and that in California lies an extensive communication system of more than 100 powerful police-owned radio telegraph stations. These serve as a link between the teletypewriter systems in the east and west, and also are the principal means used for intercommunication among some 1400 police agencies in middle-western states.

All of these facilities have been organized to form what is known as the National Police Communications Network. This well integrated police communication system extends from coast to coast and from border to border. Messages may be sent or received over this vast network without charge—which means that the county sheriff can call in the assistance of police throughout the country, if need be, to apprehend a criminal.

Exchange teletypewriter service (TWX) also is widely used by law enforcement agencies. In some states, TWX serves primarily to supplement the private-line systems in maintaining contact with out-of-the-way police stations. In other states, which do not have private line networks, this service is the chief means of interchanging written communications among major police units. Use of this service is not confined to municipal and state police agencies. The Federal Bureau of Investigation, for instance, has over 50 TWX stations at key locations to coördinate the activities of their alert forces throughout the country.

The Bell System's Share

THE TELEPHONE COMPANIES, because of their specialized knowledge of communications, render valuable assistance in improving police communication arrangements. Many of the companies have assigned men to specialize in police communications, especially in the larger cities, and work constantly with police officers to better their communications facilities.

Keeping one jump ahead of crime calls for constant vigilance and for the use of the best and latest developments in many fields, particularly that of communication. It is a job that presents a continuing challenge to the skill and ingenuity of both police and telephone people, a job that goes forward every day "behind the scenes" and affects the lives of us all.

Forest Fire: What an Unchecked Holocaust Wrought in Maine

Timothy P. Mannix

In the past quarter of a century these pages have more than once chronicled hurricane, sleet storm, flood: the destruction each has caused, the heroic efforts of telephone men and women to keep the lines open, to restore service at the earliest moment possible. Now to the roster of nature's assaults upon the telephone is added another kind: forest fire. Mr. Mannix, who is employee information supervisor of the New England Telephone and Telegraph Company, visited the stricken area in Maine while embers still were smouldering, and, deeply moved by what he saw, wrote for a special edition of Telephone Topics, *the employee magazine, the narrative from which the following paragraphs are taken.*—EDITOR.

FOREST FIRES of awe-inspiring proportions, feeding on drought-stricken timberlands and whipped by 50-mile-an-hour winds, swept uncontrolled through many sections of New England during the latter part of October.

While the loss of lives was comparatively small, the destruction of towns, homes, and valuable forests was on a much larger scale than in any previous disaster.

Where the fires reached their most voracious intensity, nothing was left but scorched earth and scarred timber—except for fireplaces and chimneys, which ironically man had fashioned for fire.

Throughout the raging holocaust, men and women battled gallantly to check the rampaging fires. Their struggle against insurmountable odds was one of courage and heroism. It was a heart-rending exemplification of the indomitable spirit of man fighting to save what it had taken a lifetime to build.

In every fire-swept area, telephone men and women were performing notably on the communications front. As power and light facilities were disrupted, the telephone became the principal medium for communication between fire-fighting, relief, police, and military organizations.

The story of their achievements would require volumes to tell. In this special edition of *Telephone Topics* we attempt to capture their spirit of service in highlight fashion only. While it is a story of Maine, it is meant as a tribute to every telephone man and woman in New England whose response to their public trust was unselfishly exemplified.

Complete devastation and destruction on a wholesale scale were perhaps most graphically portrayed on Mount Desert Island. Here, the fabulous Bar Harbor summer resort saw destruction running up into millions of dollars. As far as the eye could reach on either side of the main arteries leading into the Bar Harbor business district, virtually everything was reduced to rubble . . .

IN THE LATE AFTERNOON of October 23 it became apparent that the fires sweeping

The hot breath of onrushing fire

through the forests surrounding Bar Harbor were beyond control. A fifty-mile gale whipped the furious fires into a raging inferno that resisted every effort of the emergency forces. Gradually every road leading out of the business district was enveloped in a blaze of flame. There was no way out.

Telephone Manager John Conti, Jr., recognizing the severity of the situation, appealed to the Navy and the Coast Guard to send boats to evacuate the people from the town. Nearly 35 boats of all kinds, including two destroyers and the Coast Guard Cutter *Bibb*, were sent.

When the town was completely surrounded by fire except on the ocean side, more than 2,000 people gathered on the municipal pier for evacuation. Only a small portion of them was taken off, however, for the 50-mile gale whipped Frenchman's Bay into such a fury that it was impossible to bring boats to the pier.

When the fire reached two principal points only 400 yards from the central office, the wind veered sharply and unexpectly, and not only was the town saved, but also the lives of the men, women, and children who were trapped between the fire and the sea.

In the Bar Harbor central office, every conceivable effort was being made to maintain communications. With all power and light gone, the central office operated on emergency power and was the sole source of communication available to the people of Bar Harbor.

The walls of flame, less than a quarter of a mile away, were reflected in the windows of the central office and played fantastic tricks on the faces of the operators at the switchboard. The central office was filled with smoke and the heat from the approaching fire was so intense that the fire department was summoned to play streams of water on the outside of the building so that the operators could continue to handle the calls of relief agencies, fire, and police departments, and help to dispatch all fire-fighting units from one spot to another as they made a last-ditch stand before the fire swept them into Frenchman's Bay.

Many of those girls worked 60 or 70

hours, snatching cat naps on cots and eating cold sandwiches. For some of them had no homes to go to, and only food provided by the relief agencies was available on the encircled island.

Some who worked through the night of fire and chaos lost their homes and many did not know where their parents or their children were, but despite the uncertainty of the whereabouts of their immediate families and despite the certain knowledge of the loss of their homes and personal property, they continued to work on at the switchboard.

At Seal Harbor, on the other side of the island, all women and children were evacuated—all the men were fighting the fires. All the women, that is, except two operators, Ruth Donnell and Ada Bowden, at the Seal Harbor central office. With all roads blocked by the fire, the women and children of Seal Harbor were evacuated on the Mission boat "The Sunbeam."

The two Seal Harbor operators continued on the job and served at their switchboard throughout the week, catching a bit of sleep only when it was impossible to go on any longer without it. They were dependent on passing trucks for food, for there was no food available on the island except from relief agencies.

Early on Tuesday they lost their lights and their power, too, and had to use a hand generator for ringing. A kerosene lamp, placed on the switchboard between them, provided the only light for its operation for the next three nights. Plant workers jacked up the switchboard in the hope that they could remove it in the event the fire reached the community. A boat was kept on hand for the evacuation of the two operators.

Throughout the week, the changing wind kept building the tension as the fire moved from one section of the harbor to the other, but never did quite reach the settlement. On a small table behind the

The white line indicates where the fire halted its assault on Bar Harbor

The Bar Harbor central office was filled with smoke as the operators worked tirelessly through a long night of suspense and danger

These operators were the only women permitted to remain in Seal Harbor while fire threatened. A kerosene lamp was their only illumination and a boat tied nearby would have been their only means of escape

girls was a lonely and bedraggled bouquet of flowers, snatched from a roadside garden by the fire chief of Seal Harbor, who took time off during the height of the fire fighting to present them to the operators with the remark, "We would be lost without you. Please keep going."

A few miles away at Northeast Harbor a similar situation existed. Five operators, under the direction of Chief Operator Beatrice Foster, remained at their switchboard positions throughout the week. They, too, were without lights on Tuesday, Wednesday, Thursday, and Friday, but did not lose their ringing power. They used candles, lanterns, flashlights, and kerosene lamps to illuminate the face of the board. Their suitcases were packed and standing in the central office, while at the foot of the outside staircase a fishing boat stood ready to evacuate them if the fire struck Northeast Harbor.

These operators, Viola Murphy, Ruth Wilcox, Glennis Reed, Helen Gillette and Philena Davis, supervised the entire evacuation of the town. On order of the town manager, they sounded the evacuation alarm and then called every telephone to explain the necessity of the evacuation. When the evacuation was completed, they were the only women left at Northeast Harbor.

Wire Chief Sheldon Littlefield and his crew had the narrowest kind of escape

from death. Working along a pole line in Bar Harbor, the fire, which moved with the speed of a race horse, shot across the road in front and back and trapped them. Their five motor vehicles were driven across the face of the fire to safety. They felt lucky.

When the fire threatened West Newfield, 40 miles above Portland, the Plant people jacked up the switchboard in the West Newfield office, put it on a truck, and drove it away.

The fire approached to within seventy-five yards of the central office when the wind, which designed a crazy-quilt pattern in its week-long orgy of destruction, suddenly veered and left the center of the town untouched. The switchboard was quickly put back in service and continued on, although the town was threatened several times again . . .

BIDDEFORD, which had been on the anxious side throughout the week, was close to evacuation on Thursday night when the fire which had roared through Lyman and Waterboro suddenly swerved toward the city. The fire came within 200 yards of Webber Hospital and the patients were just about to be evacuated when the fire was checked.

In the Biddeford central office there was the same terrific tempo that characterized all of the central offices in the fire area. Operators worked continuously without returning to their homes as all relief agencies virtually poured their calls through the central office as they attempted to evacuate families in the vicinity of the approaching fire. One operator answered a call from a woman on an outlying road who had been isolated in a farm house with her two children and had no means of leaving. They were rescued by Red Cross workers sent to the scene by the operator.

As in other affected areas, the central office was the principal means of communication for the police and fire-fighting agencies. Two new sections of switchboard recently cut into service were used to handle all fire, police, and fire-fighting calls as a means of relieving some of the

Scenes like this were typical of what the fire left of parts of Bar Harbor

Once there was a telephone . . .

congestion from the regular positions. Here again operators worked throughout the chaotic Thursday night not knowing of the whereabouts of their families or the safety of their homes. Several of the operators who lived in the outlying districts lost all of their belongings when their homes were destroyed.

While many towns and villages were destroyed there was none more completely obliterated than the township of Brownfield. When the flames swept down from the surrounding hills and through Brownfield, they left behind nothing but one house and a wooden railroad station that was only big enough to have the name of the town written on it. From the vantage point of the bridge leading into the town and looking down the main street as far as the eye could see, there was nothing left but black chimneys and charred trees. The town was gone—it was a ghost town.

In the center of the town, where once an attractive little green stood, was nothing but scorched earth. In the rear, white slabs of marble that marked the graves of the town dead were black. Every bit of vegetation was gone. Against this blackened background of what was once the gathering place of the townspeople was a wooden billboard—a small one, perhaps six feet by four feet. It was black and gold and white and although everything around it was burned, it retained the same black and white and gold as when it was originally painted—it hadn't been touched by the fire. It was the monument to the World War II dead of Brownfield.

In every city and town and village in the fire-affected areas key people were called on by representatives of the Commercial Department. The Commercial people explained the telephone situation and the plans that had been made for emergency services. In some instances, such as Ellsworth, to which the majority of Bar Harbor people were evacuated, the Commercial Department established an entire communications set-up for the community and after assigning key telephones for all agencies drew up a directory of telephones for the information of all key people.

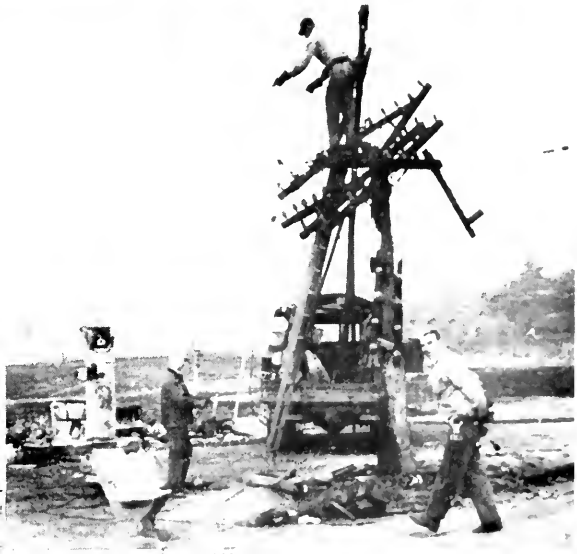
Damage to telephone plant was comparatively light. A total of 472 working stations and 293 left on premises, as well as three PBXs, were destroyed. Telephone poles destroyed or to be removed totaled 1183 and 65 circuit miles of open wire had to be replaced.

One-half mile of local exchange cable, 100 pairs or less in size, was burned out. While fire swept across seven miles of the Boston-Portland toll cable, only 1550 feet of toll aerial cable had to be replaced. Of the 5½ miles of toll cable serving Bar Harbor that was swept by fire, only 750 feet had to be replaced.

Rain came Wednesday, October 29. It was too late.

Above: All that remained of the Jackson Memorial Cancer Research Laboratory at Bar Harbor

Right: This was once a working telephone line



Below: A telephone operator surveys what is left of her home at Biddeford

The USAF Inaugurates a Facsimile Service to Distribute Weather Charts to All Air Force Fields over Bell System Circuits Forming the Largest Network of Its Kind

Weather Charts by Wire For the Air Force

Harry Jeavons

"WHAT'S THE WEATHER going to be?"

That is the question which has been asked most often since history began.

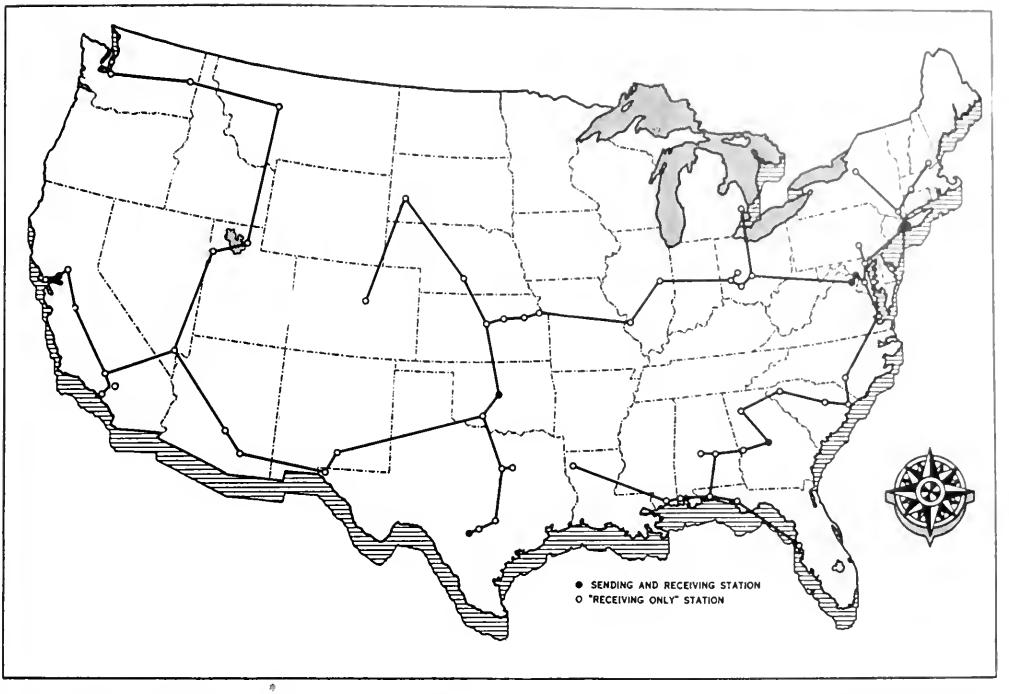
To the pilots of today's airplanes, the question is not one of idle curiosity. They rely on knowledge of what the weather is along the routes they intend to fly and what it will be at their destinations when they expect to arrive. Men fly today with regularity and confidence because they have been told what weather lies ahead.

This accomplishment, this knowledge of specific weather conditions and probable changes all over the world, reflects the effort of countless scores of individuals, of countless thousands of observations over large sections of the globe. It includes the tremendous job of marshaling the forces to collect and plot the data, to analyze the significant factors, and to determine those fundamental conditions which influence the weather at any point. It is a time-consuming and tedious process, but it gives assurance to the pilot of a plane that, short of unforeseen or unpredictable conditions, he should be able to reach his destination at a given time.

To improve the collection and dissemination of weather information and to extend its scope, the Air Weather Service of the USAF (the United States Air Force) recently inaugurated a plan whereby weather charts for all of North America and the adjacent ocean areas are prepared at a central point and distributed by a facsimile process to all Air Force fields in the continental United States.

Transmission requirements of the facsimile services are such as to require high-quality telephone-type facilities, which the Bell System is able to provide.

The facilities now being furnished for the USAF consist of four separate networks of telephotograph (fac-

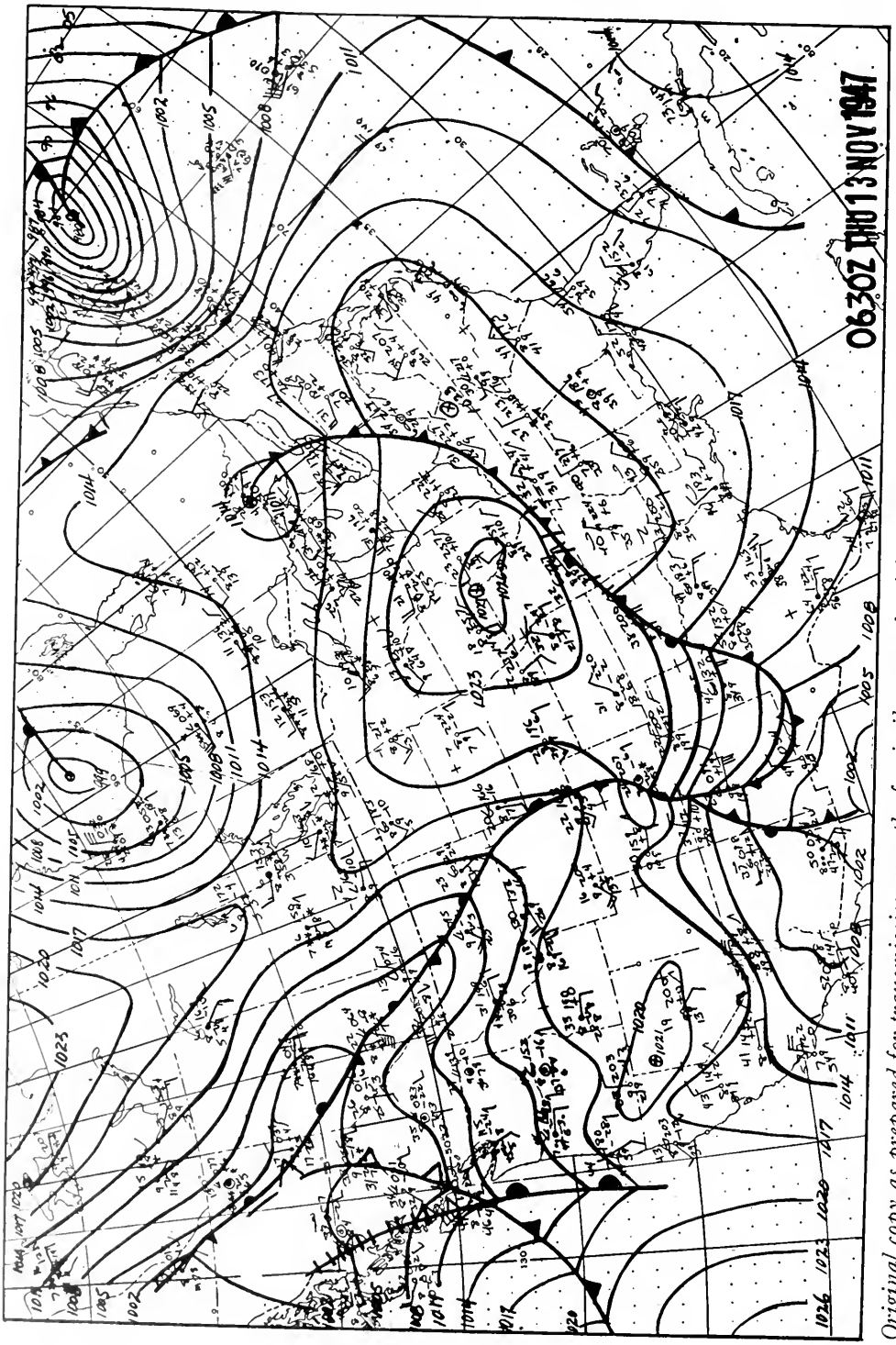


The Air Force Weather Map facsimile network provided by the Long Lines Department serves air fields and bases throughout the country

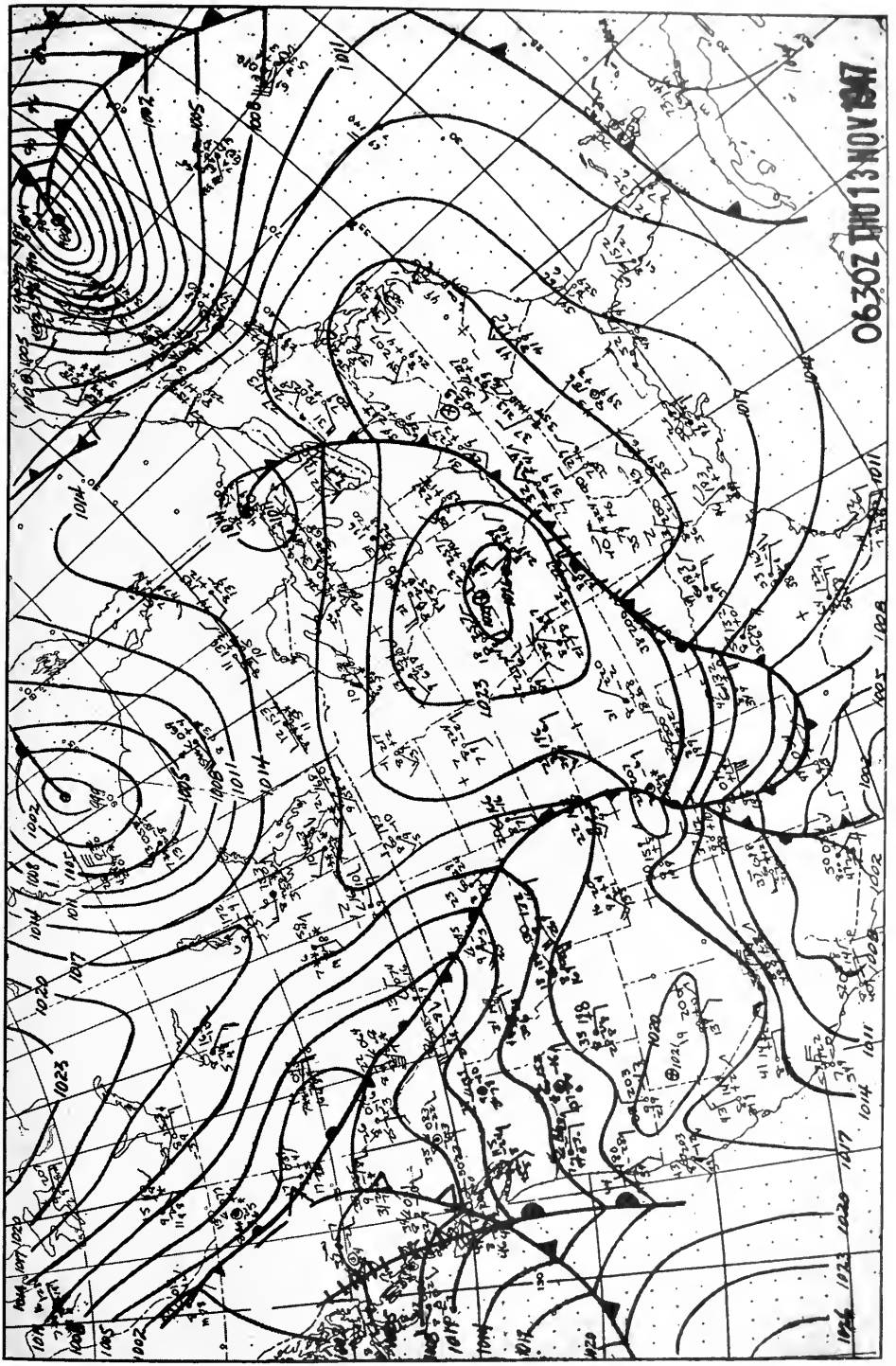
simile) transmission channels. These networks connect nearly 100 Air Force fields throughout the entire United States. The networks can be interconnected so that one sending station may transmit to all receiving stations. At present, the primary sending stations are located at the WBAN Analysis Center (Weather Bureau, Army, Navy) in the Weather Bureau Building, Washington, D. C., and the Air Force Weather Central in the Pentagon Building across the river in Arlington, Va. Secondary transmitting stations, at which more detailed weather information is plotted and analyzed and may be transmitted within its own regional territory, are located as follows: *Northeastern Section,* Mitchell Field, L. I.; *Southeastern Section,* Warner Robins (Macon), Ga.; *Central Section,* San Antonio, Tex., and Oklahoma City, Okla.; *Pacific Section,* Fairfield-Suisun (Sacramento), Calif.

Approximately 15,000 miles of circuits are employed in furnishing the facsimile network, and in its entirety this system represents the largest of its kind ever attempted.

The Long Lines Department, which is responsible for providing most of this nation-wide network, handled the Bell System arrangements with the USAF. Nearly all of the System's operating companies, and some independent connecting companies, also participated in furnishing the service by providing sections of the inter-city wire facilities, local



Original copy as prepared for transmission over the facsimile network, giving a general surface analysis based on observations at 11:30 A.M., Eastern Standard Time (6:30 A.M. Greenwich Time) on November 13, 1947



The same map as received, showing dark lines on gray background. These illustrations are reduced in size; both original and received copies are 12 by 18 inches

channels, and some of the personnel required for the installation and maintenance of the service.

What Is Facsimile Transmission?

FACSIMILE TRANSMISSION, speaking generally, is the transmission of signal waves, produced by the scanning of fixed graphic images, which are reproduced at the receiving point in record form without further processing after transmission is completed.

A sheet containing the image is wrapped around a "sending" drum, which is caused both to rotate and to move along its shaft. An "electric eye" scans the image and produces changes in signal level which are transmitted to a distant recording instrument that duplicates the image on a "receiving" drum synchronized with the sending drum.

In the case of the Air Force facsimile installation, recordings are made on a specially prepared paper with a conductive backing by a burning process. A stylus, connected to the output of the recorder amplifier, impresses a high voltage at the stylus point when strong signals are received. The heat from the high voltage burns off a surface coating on the specially prepared paper, thus exposing the dark backing. This produces copy with a background of light gray color while the lines or markings of the original appear in dark gray shades.

Another form of paper is also in use which permits multiple reproduction of received material.

The facsimile process differs from the telephotograph process so familiar in the Bell System in that the former is in general considered as reproducing the original without intervention of a photographic operation and without producing a full range of tones from black to white. Telephotograph transmission is usually considered as utilizing a photographic process and as affording a full range of tones.

Once the basic weather information has been plotted and analyzed in chart form, the fascimile method permits the transmission of the completed chart in about 20 minutes; and this provides the forecasters at individual Air Weather Service stations with comprehensive data from which local and route forecasts can be developed without loss of time and without detailed clerical operations on their part.

The Development of Weather-chart Facsimile Transmission

DURING WORLD WAR II, the Air Forces were faced with the tremendous problem of providing operational units with accurate forecasts of weather conditions over base and target areas under conditions in which time was of utmost importance.

Because of the complexity of air operations, it was essential that commanding officers have accurate forecasts available well ahead of planned operations. Also, because of the large areas involved in both the European and Asiatic theaters, it was essential that forecasts at many points be coördinated. To complicate the problem, comparatively few well-trained meteorologists were available. As additional personnel cannot be trained over night in this field, the Air Weather Service established weather centrals to compile and analyze weather data and to provide briefing officers at each command

post with accurate and up-to-the-minute information so that they could intelligently plan their operations.

Various methods were tried for transmitting the information, and the most successful proved to be a system of briefing charts which defined wind and cloud conditions that might be encountered over the base and target areas. This information was plotted on a map in a series of heavy lines—which appeared to lend itself perfectly to facsimile transmission. After considerable experimentation, a facsimile transmission network was established, and it continued to serve successfully throughout the invasion of France.

This balloon is carrying instruments aloft which will radio their records of upper air conditions to observers on the ground

Hitherto, the transmission of weather information to the forecasters at all domestic Air Force fields had been limited to the use of private line teletypewriter networks of the Air Force and the Department of Commerce through a system of coding the locations of isobars and other lines as passing so many miles east or west of certain fixed reference points. This system, while transmitting complete data, used large amounts of teletypewriter circuit time and required personnel at each air base to decode and redraw a rough copy of the weather chart.

With this experience of successful facsimile operation under war-time conditions, the Air Force was confident that a similar arrangement, operating full time, would make it possible to provide each domestic air base with comprehensive weather information—and require less personnel than the older method of weather map preparation.

In order to iron out the "bugs" and to determine more accurately the potentialities, an experimental facsimile service was established in 1946 which interconnected various Air Force, Navy, and Weather Bureau stations in metropolitan Washington with Langley Field, Va.

The experiment proved the point. In addition, added incentive was provided when during the course of the experiment the Air Force determined that the plan permitted Air Weather

Service to release for overseas service five skilled weather forecasting and plotting specialists at each full-time domestic weather station.

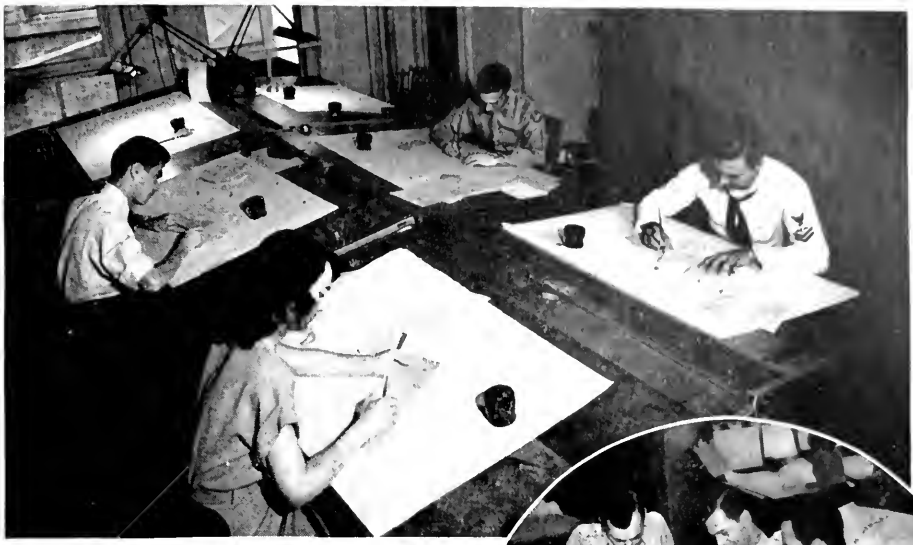
The Weather Analysis Center

In Washington, D. C., the Air Force, the Navy, and the Weather Bureau jointly created a master center known as the WBAN Analysis Center. To it all available weather information is brought by teletype.

Information compiled at Weather Bureau stations, Civil Aeronautics Administration observation points, and Naval Aerological and Air Weather stations, as well as weather information obtained through international exchange agreements with foreign governments, is all concentrated at WBAN. Private-line teletypewriter networks of the Airways and Air Communications Service (the operating communications agency for the Air Force), the Civil Aeronautics Administration, the Weather Bureau, and other communication channels, are used at WBAN to receive readings of their multitude of instruments from weather observers in all parts of the country. These data are transmitted to Washington in long teletypewriter messages full of numbers and strange symbols which are meaningless to anyone but trained personnel.

While the data come in as a continuous stream, they actually represent a series of weather observations made at specific and precise times throughout the day. Each weather

Reports from observers all over the country flow into the Weather Analysis Center over private-line teletypewriter circuits which terminate in this room. Air Force, Naval, and civilian personnel typify the joint interest of the Military Forces and the Weather Bureau in the undertaking



Plotting and Analysis. Above: These four plotters are entering observation data on large separate sectional maps, which will later be pasted together. It takes eight such sections to cover the country. Right: Drawing the pressure and temperature lines on the weather map—the next step—requires expert interpretation of the observation data

observing station reports its reading in fixed sequence, and in spite of the "short-hand" techniques it may take well over an hour to collect the information from all stations in North America.

As the weather data become available, they are given immediately to a group of plotters in the WBAN Analysis Center whose job it is to enter the data on a large-scale chart so that they may be more comprehensively understood in the later stages of weather analysis. The work is sub-divided among several plotters so that several sections of the country are being plotted at the same time.

As fast as these sections are completed, they are passed to a group of weather analysts. These analysts include some who specialize in the analysis of surface weather conditions, while others concern themselves only with the analysis of upper air conditions. The job of these analysts is to convert the data on the chart sections into those strange, wandering lines, known as isobars, which are familiar to all who have ever attempted to read a weather chart or map and which give the trained fore-

The objective of the whole process is an accurate local forecast by the Air Force weather man at each air field. H. G. Stommel, technical assistant at Weather Analysis Center, is here shown working on a prognostic chart such as is shown on the opposite page which will go out over the facsimile network to assist in this final step

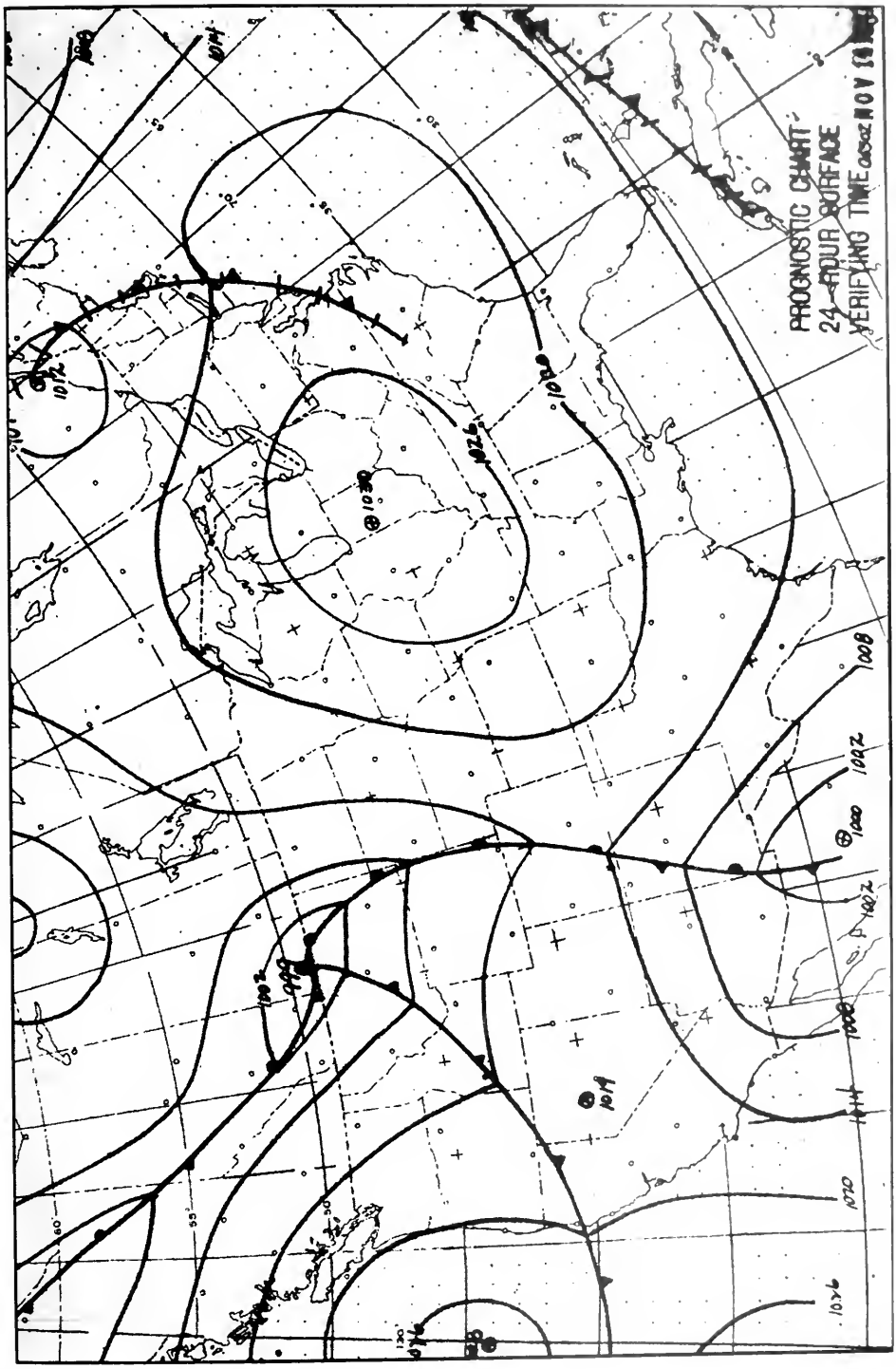
caster an instantaneous picture of the high- and low-pressure areas.

Other information interpreted by the analysts is the location of so-called "fronts"—the boundary areas between large masses of warm and cold air. By comparison with earlier charts, the analyst is able to show the direction of movement of the fronts. Such analyses, particularly of surface weather observations, are no mere matter of routine drafting. Many local conditions—the nature of the surrounding terrain, hills or mountains, rivers or other large bodies of water, other topographical conditions—can influence the recordings at any single point and it takes a trained and skillful analyst to interpret the data correctly.

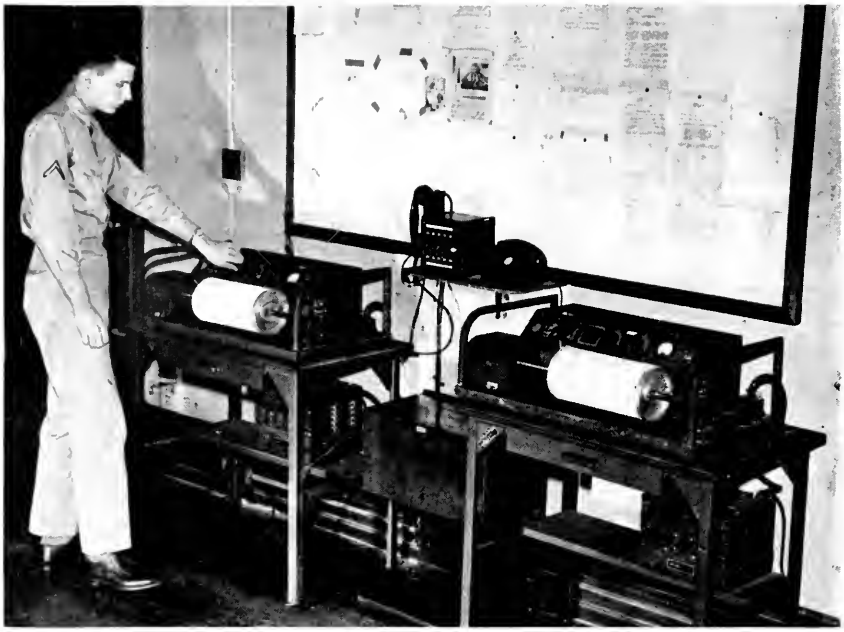
While the plotters and analysts are creating the large detailed chart, based on observations from all sources, another group of plotters is working on a smaller set of charts which will fit the 12″ × 18″ limitations of the facsimile transmitting and receiving equipment. When the plotting is completed on these smaller charts, the isobars and other analysis lines of the larger chart are copied and the final chart is then ready for transmission.

All of the work thus described must be done with a fixed deadline in mind. In general, about an hour and a half is allowed to collect data and to plot and draw up a general surface analysis for the territory of the United States.

Today, with the facsimile network an accomplished fact, about 40 maps or charts are regularly transmitted daily from Washington. For in-



Prognostic chart sent over the facsimile system. It was drawn from data collected at 11:30 A.M. EST on November 13, 1947, and represents what a map drawn 24 hours later is expected to show.



On the wire: A 12- by 18-inch reduction of the large working map goes on a facsimile "transceiver" for transmission over the Weather Map Network to all Air Force fields and bases in the country. The process takes about 20 minutes. The machine at the right is standby equipment

stance, a general surface weather analysis is transmitted four times daily. General analyses of conditions at various altitudes from 2,000 feet above sea level up to 25,000 feet and higher are transmitted twice daily. Also plotted and disseminated daily are various Upper Air Soundings, Winds Aloft (actual for various centers), and 24- and 48-hour and six day (long range) weather forecasts.

In addition to the WBAN Analysis Center, the USAF continues to maintain its own central headquarters, known as the Air Force Weather Central, in the Pentagon Building. Weather observations are received at this location over the USAF's own network as well as the CAA and Weather Bureau networks; and they also receive all weather charts originated by WBAN. The primary purpose of this station is the preparation of long-range and long-distance oceanic forecasts in the same manner WBAN prepares its weather charts. Its products are employed principally in connection with flights outside of the United States.

Plans for the USAF facsimile network began early in 1946, when the Long Lines Department received a request from the Signal Corps, as the agency of the Army and Air Force responsible for the coördination of engineering and technical details, for a nation-wide network for use by the Air Force and capable of transmitting weather charts or similar information. A series of conferences followed, to determine the characteristics of the transmitting and receiv-

ing equipment the Air Force proposed using, and the various factors influencing the circuit arrangement and control of the proposed network. These conferences created the "know what" which in turn led up to the problems to be met in developing the "know how."

Engineering the Weather Facsimile Network

BECAUSE the network was so large and most points were to be equipped for "receiving-only" service, several engineering problems were introduced into the design and initial set-up. Circuits for facsimile transmission must be "delay equalized"; that is to say, special precautions must be undertaken to insure that all necessary frequencies travel through each branch of the network at the same speed. However, due to the "receiving-only" characteristic of many sections of the network, established methods of measurement necessary to proper adjustment would not work because they depended on a return path exactly similar to the one being measured. Such return paths either did not exist or were very difficult to achieve. The Long Lines Engineering Department, however, designed special apparatus called a "signal shifter" which makes such measurements independent of the return path and thus solved the problem. It promises to simplify delay measurements on all circuits.

This USAF network was so extensive, and its establishment presented such novel problems, that, as equipment and facilities became available, portions of the network were set up and, in coöperation with the Air Force, tests were conducted. In this way, circuit troubles and errors in design were located and corrected before the channels were turned over to the customer.

The major problems of design were practically all resolved by the late summer of 1946, and in August of that year orders were received for the facilities. Work on all phases of the job was immediately stepped up, and in April of 1947 the first of the four sections of the network—the Northeastern section—was turned over to the Airways and Air Communications Service. The second or Central section was turned over in September; the third or Southeastern section in October; and the final or Pacific Coast section in November of 1947.

Since the establishment of the USAF weather chart facsimile transmission system, the merger of the Armed Forces has been consummated and plans for the expansion of the network to include Naval Air Stations are well advanced. Further evidence of the value of the new system to aviation generally is the interest being taken by the commercial air lines, which, having seen it in operation, are enthusiastically inquiring about the possibilities of being hooked into the network.

Twenty-five Years Ago in the BELL TELEPHONE QUARTERLY

Items from Volume II, Number 1, January 1923

A. T. & T. Co. Headquarters

CONSTRUCTION of an addition to the Telephone and Telegraph Building, New York, national headquarters of the Bell System, which has been under way for some time, has been completed and the ground floor was thrown open to the public on November 1. The frontage on Broadway now extends from Dey Street to Fulton Street, the depth being about 275 feet on the former and about 167 feet on the latter. The Telephone and Telegraph Building now occupies a total ground space of 36,000 square feet. It has twenty-six floors.

The Greek style of architecture employed in the old building has been followed in the new structure, Doric columns being used in the lobby and for the first floor exterior, while the exterior columns on the other floors are Ionic. Simplicity and dignity, combined with an impression of enduring strength, are outstanding characteristics.

In no case has utility been sacrificed to artistic effect and the result is a building which is as near perfection from the standpoint of utility as it is from that of beauty. Thirty elevators carry the occupants of the offices to and from their work, while the enlarged lobby prevents congestion, even during the busiest hours of the day. . . .

Besides the headquarters organization of the American Telephone and Telegraph Company and certain departments of the Western Electric Company, the manufacturing branch of the Bell System, the building is occupied by the executive offices of the Western Union Telegraph Company. Its present occupants number about 4,400 but provision has been made for a maximum capacity of 6,000. This will care for the expansion of the telephone organization for some time to come.

From "Notes on Recent Occurrences."

Machine Switching in New York City

THE FIRST machine switching telephone central office in New York City was placed in service on October 14, at midnight, when 1700 lines of the Pennsylvania exchange, which numbers several of the larger metropolitan hotels and department stores among its 10,000 subscribers, were "cut over" from the manual switchboard to the new mechanical equipment.

An intensive campaign of personal instruction to subscribers had been carried on by the New York Telephone Company, with the result that no difficulty was experienced in the use of the dial and the new apparatus is functioning with satisfaction to both the telephone users and the company.

On November 18, approximately 1200 additional lines of the Pennsylvania exchange were transferred to the machine switching equipment, and others are to be added gradually until the entire exchange has been put on a mechanical basis.

The second office to be transferred to the machine switching equipment was Academy, serving one of the uptown residential districts. On December 2 about 4,000 lines served by the manual type of switchboard of this exchange were "cut over," and others are to follow shortly. The next exchange scheduled for transfer to the machine switching equipment is Walker.

The transfer of the Pennsylvania exchange is the first of a series contemplated by the New York Telephone Company. Difficult engineering problems are involved and the manufacture of the intricate apparatus used in connection with the machine switching equipment requires the most painstaking accuracy in every detail.

From "Notes on Recent Occurrences."

A National Telephone Service

We believe that the best results for the service and, therefore, for the public will be attained by a relation of confidence and co-operation between the commissions and ourselves. We intend to deserve the confidence of the commissions by the utmost frankness and straightforwardness in our dealings with them, and we hope for a time when the commissions will be kept so well informed continually as to our operations and results and problems and necessities that the great expense of occasional investigations may be saved. We are making systematic efforts to widen the ownership in the Bell System because people will inform themselves and their neighbors about the operations of an institution in which they are partners, and we welcome every opportunity to increase the knowledge of our operations among telephone users. No institution is more publicly owned. Its plant has been built out of savings of the people. It is being extended out of such savings. It is the people's institution more than any other. . .

The interest of the public and our interest are identical in the direction of greatest value which includes greatest extension of the service at fair rates. Sound, efficient and economical regulation involves, therefore, coöperation between the commissions and our companies to produce that result. It involves, when the time comes for a change of rates, a study between them as to what increase or decrease in revenue is indicated, followed by another study on rates with a view to effecting the necessary change in such a way as to make the service available to the greatest number.

I can imagine a commission, in fulfilling its obligations, calling to account a company not sufficiently alert as to its conditions and instructing it that its rates must be increased so that its service to the public may not be in danger. There have been cases where that kind of caution was necessary.

Commission regulation, on the whole, has been satisfactory. We have intended to present our views to them fairly, completely and in a straightforward way. We haven't always reached our standards. Commissions as a rule have manifestly intended to be judicial and fair. Occasionally they have temporized. They have during the past three or four years passed through a very difficult period in which, in order to maintain service of the utilities, rate changes have been advances and not decreases. . . .

We are studying the probable telephone requirements for the next five, ten and fifteen years; we are considering the new capital that will be required to meet the demanded growth; we have men studying the innumerable inventions and technical improvements without which we could not reach our objective. We have to think in big figures,—big figures of labor, material and financial resources, for if we did not, we would be overwhelmed by the increasing public demands.

If we can make you see our objective as we see it, if we can make the picture of the future live in your minds as it does in ours, I am confident that you will see it as an objective of far-reaching national importance, which commands the utmost seriousness on your part, and on our part, and that from that seriousness should come such coöperation as will bring the results which the country demands.

From an address by the late Harry B. Thayer, former president of the American Telephone and Telegraph Company, at the Thirty-fourth Annual Convention of the National Association of Railroad and Utility Commissioners in Detroit on November 15, 1922.

Handling Subscriptions for the A. T. & T. Company's Huge $357,532,600 Convertible Debenture Issue Called for Careful Planning and Efficient Organization

The Biggest Offer Ever

Frederick A. Wiseman

LIKE MILLIONS of other lights twinkling in metropolitan New York, the windows in the office building at 299 Broadway grew brighter as darkness fell over Manhattan. At long work tables on the thirteenth floor, half a hundred women and girls flashed their shiny letter-openers to and fro like tiny sabres. In this group were Mrs. Thompson, whose husband had doubted the wisdom of her taking an office job, and Ann Hobart, who is going back to school again in February. Ann had let it be known that she thought the boss was swell, and she and Mrs. Thompson had agreed with the others that the telephone company was a nice place to work.

A housewife . . . a schoolgirl: two people with not much head for corporate financing, perhaps, but glad —and proud—to be part of the organization that handled the largest piece of financing ever undertaken by a private corporation—A. T. & T.'s recent $357,532,600 convertible debenture issue.

The mammoth offering to stockholders was the latest step in American Telephone and Telegraph's postwar financing for continuing the greatest construction and expansion program in Bell System history.

With the mailing of proxies, prospectuses, and warrants already accomplished, the task of handling subscriptions for the new debentures was itself an undertaking of very large proportions. Like a military operation, it had required months of detailed planning. Organization lines had to be established, and more than 700 people assembled and trained in their duties. Working space had to be procured, and furniture and other equipment moved in. Schedules had to be arranged so that the organization, functioning smoothly and efficiently, could handle, completely and without a hitch, as many as 40,000 pieces of incoming mail a day.

The planning began last spring as part of the program to raise the new capital that must be obtained in order

One of the reviewing groups. Here subscriptions and transactions in rights were thoroughly reviewed and were classified for further handling

to provide for the American people the expanded telephone service they are demanding.

Objectives—and People

GOOD EXPERIENCE had been gained from the convertible debenture issue of December 1946. But for the new offering many improvements were planned. Special attention was to be devoted to the following:

- Improvement in the routine procedures.
- Closer contacts and better relations with brokers and investment dealers handling large transactions in rights and subscriptions for the debentures.
- Improved working conditions for the personnel. (In 1946 the inadequate space available for the work proved to be a tremendous handicap.)
- More and better-qualified supervisory personnel for assignment to the organization.
- More extensive training for temporary employees engaged for the work.

All of the above objectives of the pre-issue planning were achieved in very large measure. From an operational viewpoint, that fact plus the better day-to-day supervision of the work had a marked effect on the success of the issue.

While some experienced telephone personnel from A. T. & T. headquarters at 195 Broadway and from nearby Associated Companies provided a supervisory nucleus, nearly 600 temporary workers had to be recruited from outside sources. Most of them were women. Stenographic experience was necessary in some cases; just common sense in others.

To secure these 600 people, the Treasury Department wrote to the placement bureaus of 29 eastern colleges and universities, from Massachusetts to North Carolina, in the hope of reaching students awaiting the opening of the February semester. In addition, letters were sent to Bell System employees in the metropolitan area, asking them to assist by informing friends and relatives of the temporary positions available. The re-

sponse was very good indeed; Mother Bell found that a lot of people wanted to work for her, even on a short-term basis.

To the Bell System companies in this vicinity went a call for supervisory assistance. They responded generously. Excellent people—people with initiative, intelligence, and marked supervisory ability—were made available to fill important assignments in the security issue organization.

All of this added up to the best organization ever established for an A. T. & T. security issue. When Ann Hobart said her boss was "swell," she was reflecting the impression that seemed to exist in all levels of the organization. The boss, in turn, was saying that he had the best group of people possible for the job to be done. That is the spirit that makes an organization function effectively. Just contemplate this for a moment. In one division with 50 supervisory people, over a period of five weeks only one of the supervisors was absent: an absence of seven hours, equivalent to the loss of one employee day in five years.

Active employment for temporary help was under way by October 1. Some 1,500 persons were interviewed for a variety of jobs, such as clerk, machine operator, typist and stenographer. Two out of every five applicants were hired. Of the 600 new employees, one-third were college-trained, and two-thirds were women. Some, like Mrs. Thompson and Ann Hobart, were housewives and students; some were "between jobs," others just preferred temporary work to permanent jobs. While about a third of the men and women had previously worked for the Bell System, all of them had to learn the details connected with the convertible debenture issue.

This is a section of the communications division where letters of inquiry were answered and irregularities were straightened out by letter or telephone

Then there was the matter of space and tools. Five empty floors at 299 Broadway were leased, and the great trek began.

Into the temporary quarters were moved 46 van loads of furniture and equipment. There were 800 chairs, 450 tables, 225 filing cabinets, 175 desks. There were a hundred typewriters and nearly as many adding, calculating, addressing, and other machines. In addition, there were about 50 clothes racks and three-score miscellaneous items such as postage meters, safes, sorting racks, cash registers—not to mention complete furnishings for recreation rooms. And, of course, there were hundreds of warrant boxes, metal security boxes, desk trays, and the many, many stationery items that go with "paper work." The paper work actually involved tons of paper: yes, 175 tons, of which 25 percent went into the prospectus and the other 75 percent into a variety of printed forms, warrants, letters, envelopes, and other printed material.

Final verification of the subscription papers took place here before the debentures were issued

Telephones were installed. Illumination was checked. Alarm-protected vaults were constructed for the overnight safekeeping of valuable documents. Clocks were installed, coolers for drinking water rented, supply rooms set up. A nurse's office for first-aid treatment was established, and recreation rooms provided restful surroundings for relaxation during lunch and rest periods. And to enliven the atmosphere for employees assigned to the filing job, loudspeakers were installed to bring in popular and classical music.

Ready for Business

WARRANTS were mailed to our then 718,000 stockholders on November 10. By that time, the force had to be ready for its job. A week or more before, training courses had been started. Some 40 girls, most of them college-trained, spent nearly two weeks learning how letters were to be answered (there would be a certain amount of necessary correspondence with stockholders). To assist in manning a counter temporarily established in the lobby at "195" to help shareholders personally with their problems, another group of 40 people, college-trained men, underwent a 10-day period of training. Still another series of training classes was conducted for those whose tasks would be more specialized, such as processing subscriptions. And for

those who needed no such specialized training, one-day orientation sessions provided a glimpse into the Bell System way of life.

The day after the warrants went out, the mail began to roll in:—orders to buy debentures, orders to sell rights, orders to buy debentures and sell excess rights, orders to buy more rights so that more debentures could be purchased, orders to transfer rights to others. As the days went by, sacks of envelopes in ever-increasing amounts came into "299." Some of it came directly from the stockholders, some via the counter at 195 Broadway. Some came from the Company's Treasury offices at Long Lines headquarters in New York; some from Bankers Trust Company, which acted as agent for the sale and purchase of rights for the convenience of stockholders who wished to use its facilities.

Still other mail came from the A. T. & T. Treasury office at the New England Telephone and Telegraph Company's headquarters in Boston. Our company had its beginnings in Boston. At one time, years ago, most of the stockholders were located in New England, and there are a great many there now, as in the past.

About 430,000 pieces of mail were received at "299" during the five-week subscription period. The average daily number was 15,000, the biggest day brought 39,000.

The wheels of the vast production line began moving at the starting point on the thirteenth floor of "299," where the top edges of the

Debentures arrived in the custody section from the City Bank Farmers Trust Company, trustee of the issue, under armed guard

envelopes were whisked off by machinery. Then the women with the shiny letter openers—including Ann and Mrs. Thompson—slit open the two ends of each envelope to make sure none of the contents would be overlooked. The warrant, check (if it was a purchase order), and any other papers were scanned for obvious irregularities and pinned together. If everything was substantially in order, the papers were sent to the reviewing section of the Subscription Division; if not, then to the Communications Division for appropriate communication with the stockholder.

Employees worked in pairs in allotting debentures and enclosing them for mailing to subscribers

The element of human error became evident at the outset. Our stockholders as a group are intelligent people—as was indicated by the fact that the great majority filled out their requests in perfect order—but some of them made mistakes. Considering that warrants and rights are not issued every day in the year and that there are some unavoidable complexities, it would have been surprising if this had not been so. A good many stockholders made out their checks incorrectly, some inclosed the warrant but no check, and vice versa. Two stockholders mistook their warrants for checks and deposited them in their banks. Another executed all three options on her warrant—to buy, to sell, and to transfer her rights—and mailed it in with a signed-in-blank check. Then there were many who thought their receipts were bills, and sent in second payments. More than $25,000 was received by mail in cash—bills, change, and stamps—$2000 of it in one envelope, unregistered.

By and large, transactions went through undelayed. The Communications Division found that cases needing further contacts, by letter or by telephone, were about 10 percent less than for the 1946 convertible debenture issue. This was due primarily to the new simplified warrant—one piece of paper which took the place of three—and the fact that most stockholders had responded to a similar offer the previous year.

Of 12,000 cases needing reply, more than half were answered the day the incoming letter was received, and for all but 1,500 cases replies were made within two days. This is

Frequent conferences were held between supervisors of the A. T. & T. Company and of the Bankers Trust Company to dispose of any questions arising during the handling of transactions in rights for A. T. & T. stockholders

a little faster than the time most of us take with our personal mail. Our stockholders, like the users of telephone service, are entitled to courteous, accurate, complete, and prompt replies to their communications, and that is the way the work of the Communications Division was planned and carried out.

The Method of Operation

THE GREAT MAJORITY of the transactions conducted by mail went straight through without further correspondence. Upon reaching the Subscription Division, the warrants were examined carefully and sorted into various classifications:

Group No. 1 comprised "straight" subscriptions which involved no buying or selling of rights. Stockholders had been granted one right for each share of stock held as of October 31, 1947; six rights were required for the purchase of each $100 convertible debenture. These "even" warrants went straight on through the mill. The processing included grouping into blocks not in excess of 40 subscriptions each, removal of checks, registration (entailing the mailing of a receipt to the subscribing stockholder), preparation of debenture envelopes, and the allotting, enclosing, and mailing of debentures. All papers, of course, underwent frequent verification to insure accuracy.

Group No. 2 comprised subscriptions of stockholders who desired to purchase additional rights to round out their subscriptions. There were more of these in 1947 than in 1946. These subscriptions were grouped in blocks of about 40 each, for convenience in handling, and the number of rights to be purchased for the block determined. These batches of 40 were then processed by a group at "299" from Bankers Trust Company. Bankers Trust completed the purchase of the required number of rights, billed the stockholders, and sent the completed subscriptions along the trail of those in Group No. 1.

Group No. 3 comprised subscriptions of stockholders who desired to sell rights in excess of their subscription needs. These were blocked similarly, sent to the Bankers Trust people for selling and mailing of checks to stockholders, and thereafter re-

entered the subscription line for further processing.

Group No. 4 comprised warrants of stockholders who wished to sell all of their rights without purchasing any debentures. These were blocked and sent to the Bankers Trust people, who sold the rights and mailed checks to the stockholders as in Group 3.

Several handy short-cuts helped to expedite the whole job. One was the blocking procedure. Each batch of 40 warrants was given a number and each of the warrants in the block was stamped by machine with that designation. In the case of subscriptions, to the number of each a suffix, from 01 to 40, was added. Thus, the fourth warrant in Subscription Block 150 would bear the number 15004.

Such a number served not only as the block number and the company's registration number for the subscription; also, since the debentures are negotiable by any bearer and had to be registered for the mails, the number served as the United States Post Office's registered mail number. It appeared on the outside of the mailing envelope, preceded by the letters "AT."

Of course, not all the debentures were delivered by mail. The large subscribers—the banks and brokers—as well as some individuals received delivery of their securities at the counter at 195 Broadway. Delivery of the debentures was an important part of the work: important to the stockholders who used their rights and paid their money; important also to the 300 people assigned to the task of counting, checking and double checking the securities, recording debenture numbers, keeping control records, and seeing to it that each subscriber got just the right securities.

More than 650,000 individual de-

Facilities were provided at 299 Broadway for employees who had need for minor medical attention

Separate facilities were set up in the lobby of the A. T. & T. building at 195 Broadway for security holders who preferred to review and complete their transactions in unhurried comfort

bentures of different amounts were involved:—not mere pieces of paper, but securities—some for $100, others for $10,000, a few for $100,000—each negotiable by bearer like so much paper money. Here indeed was important work for the temporary employees, handling millions and doing so with such precision that there could be no loose ends, nothing out of control. Working at a time when operations were interrupted by two important holidays, Christmas and New Year's, and when the worst storms in many a decade made the daily trip between home and office an adventure, they completed the job ahead of schedule. In fact, deliveries were completed ten days earlier than for the 1946 debenture issue.

The New Warrant

In the 1946 issue, warrants were issued as full, or "even," warrants and as fractional warrants. A stockholder owning seven shares of A. T. & T. stock, for example, received a full warrant covering his first six rights, and a fractional warrant for the other one right to make up his seven shares. He also received a form for ordering the purchase or sale of rights or for subscribing.

For the 1947 issue, however, the Treasury Department devised an entirely new form. After an unknown number of drafts and re-drafts, a single sheet of paper was produced far simpler to understand and execute than any of its predecessors. Finan-

cial lingo was conspicuous by its absence; in its place simple, every-day terms were set forth clearly. This new format not only helped the stockholders, but reduced the number of contacts at the lobby counter at 195 Broadway, as well as the number of letters and telephone calls the Communications Division had to write and put through to the stockholders.

A total of $348,418,500 of the $357,532,600 in convertible debentures offered was subscribed for. This is nearly 98 percent of the total—a bigger proportion than was subscribed for in 1946. Subscriptions in the 1947 issue totalled nearly 182,000.

To get back to the people who did the job—the men and women who joined our organization for six weeks and who for the most part wanted to stay. Like Ann Hobart, they found the telephone company a good place to work. If they were impressed that a big company like A. T. & T. would take the trouble to send them individual letters of welcome, signed by the security issue manager, they were certainly pleased, when they completed their work, to receive thank-you letters personally signed by the treasurer of the company. They had found the working conditions pleasant and enjoyable. They have told us, themselves, that they liked the treatment they received.

It was actually little wonder, then, that when the time came to close the books and go home, a large number of the group wanted to stay on. Each was interviewed, and every effort was made to find a permanent place for them in the Bell System. About 100 of the 600 men and women have been employed in permanent jobs or in further temporary work. And somehow the company felt that the other 500 people would like to help out again with another security issue some day.

The New Year's ice storm which swept across the country from the Texas Panhandle to lower New England wrought damage to telephone plant of the Southern New England, New York, New Jersey, Pennsylvania, Southern, Ohio, Michigan, Indiana, Illinois, Northwestern and Southwestern Bell companies and the Long Lines Department, and several independent companies. Extent of the damage, greatest in many a year from this cause, is indicated by such Bell System figures as over 125,000 telephones and 6,000 toll circuits put out of service and 15,000 poles down. New Jersey was hardest hit, with 40,000 telephones knocked out and more than a score of central offices without commercial power for varying periods. The Western Electric Company's distributing houses in and near the storm area filled orders for telephone materials to restore service as fast as they were received. Among the innumerable items required were 32,000,000 conductor feet of lead-covered cable; 36,100,000 conductor feet of drop wire; more than a million pounds of copper, copper-steel, and steel wire; 5,600 cross arms; and 72 tons of miscellaneous hardware.

Who's Who & What's What

(Continued from page 179)

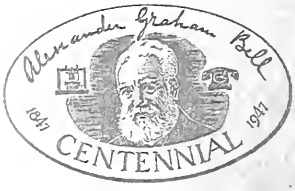
vision of the Treasury Department. In the 40 years since he joined the New York and New Jersey Telephone Company, he has devoted himself to accounting, statistical, and methods work; and he carries such kindred responsibilities as assistant treasurer of the Theodore N. Vail Memorial Funds and treasurer of the 195 Broadway Corporation and the Telephone Pioneers of America.

THE VERY PROGRESS of the [communications] art, although it produces serious problems requiring our combined judgment and experience, also suggests solutions. So far, progress in the techniques of international communications and progress in establishing effective procedures for their orderly use have contributed each to the other. I am confident that, with the same spirit of coöperation which has marked the accomplishments of the past, this will continue to be so.

Perhaps the strongest reason why I hold this belief comes out of my judgment of the character of the people who devote their abilities and energies to communications service. The very essence of communications is coöperation. That is fundamental to sending or broadcasting the message or, as we usually say in the telephone business, to getting the message through. In consequence, we whose lives are devoted to communications are so steeped in the habit of coöperation—it is such a familiar thing, so entirely natural to us—that we have every right and disposition to look forward to the ultimate fair and reasonable solution of even the most difficult problems.

It is, in fact, one of the most satisfying experiences of my 43 years in communications work, always to have found other communications men, wherever they might be, sharing this forward-looking view, which is so necessary to the progress of our service. Though we may be born to different languages, I think we have a universal spirit of service we all may be proud of, and through the advance of the art people in all countries have been able to communicate more and more freely with their fellow-citizens however distant, and with the people of other nations over land, over seas, and through the air.

A. T. & T. President Walter S. Gifford to members of the International Telecommunication Conference on July 12.



PRINTED IN U. S. A.